



# Lower Colorado River Multi-Species Conservation Program

*Balancing Resource Use and Conservation*

## Backwater Inventory: Reaches 5&6 Steps 2-3: Screening and Evaluation



March 2008

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Lower Colorado River RC&D Area, Inc.



# **Lower Colorado River Multi-Species Conservation Program**

## **Backwater Inventory: Reaches 5&6 Steps 2-3: Screening and Evaluation**

**Lower Colorado River  
Multi-Species Conservation Program  
Bureau of Reclamation  
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Boulder City, Nevada  
<http://www.lcrmscp.gov>**

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## EXECUTIVE SUMMARY

As a component of the Lower Colorado River Multi-Species Conservation Program (LCR MSCP 2004), BIO-WEST, Inc. (BIO-WEST) assisted the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) with evaluation of 25 candidate backwater sites in LCR MSCP Reaches 5 and 6. These sites were evaluated for their biological and physical potential to provide long-term habitat for razorback suckers (*Xyrauchen texanus*) and bonytail (*Gila elegans*) (LCR MSCP 2005). The methods used for this evaluation were described in the Final Model Evaluation Report (LCR MSCP 2007a) and permitted generation of a “numerical biological suitability criteria score” for each site and the ability to rate the sites according to “habitat creation opportunity.”

Of the 25 sites evaluated in this effort, 3 rated as having low, 2 as having moderate, 11 as having high, and 9 as having excellent habitat creation opportunity. Some sites were very close to being ideal candidates with little work necessary before native fish could be introduced, while others appear to require extensive efforts. Many of the sites that rated highest and appeared to be excellent prospects are currently connected to the river, which contributes to their excellent water quality conditions. If such sites were to have their surface connection restricted to prevent access by non-native fish species, the water quality conditions will change in unpredictable ways. Those that are physically closer to the river are more likely to receive good subsurface exchange of water with the river, though even this is difficult to predict because of soil conditions and other variables that influence the seepage characteristics in different locations.

Nearly all sites that had an excellent habitat creation opportunity score appear to be good prospects and the individual characteristics of the sites in that group that are not readily apparent in the scoring system (e.g., great variation in diel dissolved oxygen concentration) can be used to sort the best sites for further evaluation. Sites that rated as high in habitat creation opportunity each had slightly more cause for concern and would likely require more effort to establish native fish habitat, but these sites are, in many cases, still good prospects. In particular, we believe that sites A67.9, C67.6b, C64.4, and C62.9 are among those in the high rating category that may warrant a closer look. Sites that scored low or moderate have many issues that would cause problems and/or require excessive effort to correct.

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# INTRODUCTION

As a component of the Lower Colorado River Multi-Species Conservation Program (LCR MSCP 2004), BIO-WEST, Inc. (BIO-WEST) assisted the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) with evaluation of 25 candidate backwater sites in LCR MSCP Reaches 5 and 6. These sites were evaluated for their biological and physical potential to provide long-term habitat for razorback sucker (*Xyrauchen texanus*) and bonytail (*Gila elegans*) (LCR MSCP 2005). The methods used for this evaluation were described in the Final Model Evaluation Report (LCR MSCP 2007a) and permitted generation of a “numerical biological suitability criteria score” for each site and the ability to rate the sites according to “habitat creation opportunity.” BIO-WEST conformed to all data collection methodologies and we present the following comprehensive discussion of these methods and results from these efforts.

## METHODS

### Study Sites

The 25 candidate backwater sites and 6 alternate sites in Reaches 5 and 6 of the LCR MSCP project area were selected by Reclamation (LCR MSCP 2007b). Each site was visited and all data collected in the period between June 15, 2007 and August 31, 2007. Two of the originally selected sites (A69.7 [pools A and B] and A68.75) were deemed practically inaccessible by field crews using the equipment available for this effort and these were replaced by Reclamation with alternate sites (C53.5 and C64.1).

At each site a complete evaluation was conducted using the field worksheet developed to determine the biological suitability of the site for the classification model (LCR MSCP 2007a). The goal of these classification efforts was to determine the current suitability of a site for native fishes and use this information to infer the level of effort that may be required to create habitat to meet the requirements of the LCR MSCP. The classification model includes four components: water quality, spawning habitat, cover, and bio-indicators (LCR MSCP 2007a).

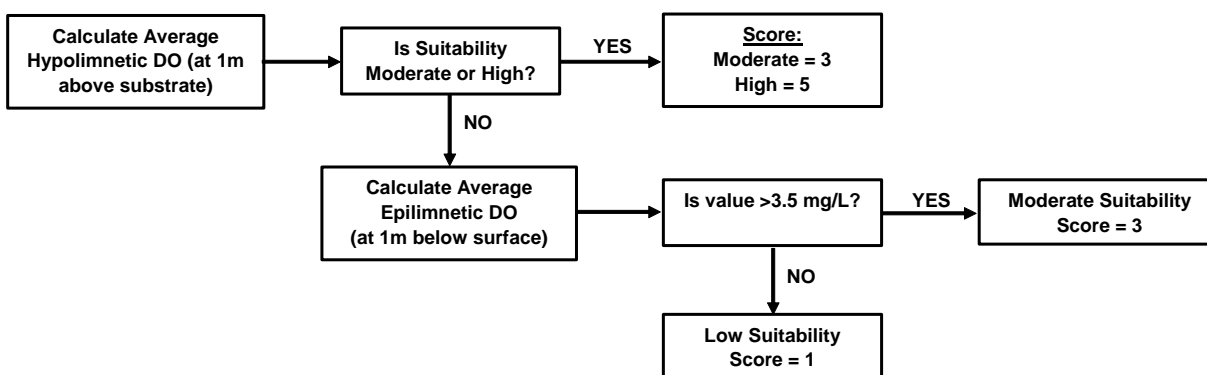
### Water Quality

The water quality portion of the classification model included several components, which were collected using the same methodology among sites. A multi-probe datasonde was used to collect dissolved oxygen (DO), water temperature, specific conductivity, pH, and turbidity at 0.5-m increments throughout the water column in three locations to develop profiles for these parameters. These data were collected between 10:00 a.m. and 2:00 p.m. local time for each site. Individual profile locations were selected to include the deepest portion of a pond and two other areas that were dispersed to represent the range of conditions in the site. The detailed profile of each pond provided useful information for evaluating overall water quality and allowed calculation of an average value (among three profile locations) for each of these parameters at 1



m above the substrate for the classification efforts (in instances where total water depth was 1 m, the value measured at 0.5 m was used).

In instances where DO concentration at 1 m above the substrate was unsuitable to support native fishes (<3.0 mg/L), an average value at 1 m below the water surface was used according to the rating classification system (LCR MSCP 2007a; Figure 1). The reason for evaluating DO near the surface is that even fish that are oriented to the bottom (including both razorback sucker and bonytail) will move higher in the water column, if necessary. However, this exposes the fish to higher water temperatures (presumably) and higher metabolic requirements (to maintain position in the water column rather than resting on the substrate). Thus a site with poor DO characteristics near the bottom but suitable DO conditions higher in the water column would still provide some value (in this case categorized as moderately suitable) for these fish. Because it is assumed that these fish would spend most of their time higher in the water column in sites with such DO conditions, average values used to score water temperature, specific conductivity, and pH suitability were calculated at the deepest location in which DO exceeded 3.0 mg/L.



**Figure 1. Flowchart illustrating the recommended evaluation of DO for the classification model.**

Supplementary to these three profiles, a multi-probe datasonde was positioned in the deepest portion of the pond approximately 1 m below the water surface using a buoy and anchor, and programmed to collect the same water quality parameters every hour for a 24-h period. These data were not used directly in the rating classification but provided a means of comparison for evaluating diel fluctuations in important parameters such as DO, which may not be apparent from the profile data.

In addition to standard water quality parameters collected from the multi-probe datasondes, we collected water samples in each site between 10:00 a.m. and 2:00 p.m. Water samples were analyzed for the list of analytes in Table 1. Water samples were collected from approximately 20 cm below the water surface with a Van-Dorn beta bottle for trace metals and nutrients (EPA

**Table 1. Water quality parameters evaluated from water samples.**

ANALYTES	
Ammonia-N	Sulfate (SO <sub>4</sub> )
Total Kjeldahl nitrogen (TKN)	Aluminum (Al)
Nitrate-Nitrite	Arsenic (As)
Total Phosphorus	Barium (Ba)
Total Organic Carbon (TOC)	Boron (B)
Total Dissolved Solids (TDS)	Calcium (Ca)
Total Suspended Solids (TSS)	Iron (Fe)
Alkalinity, Bicarbonate	Magnesium (Mg)
Alkalinity, Carbonate	Manganese (Mn)
Alkalinity, Hydroxide	Potassium (K)
Alkalinity, Total	Selenium (Se)
Specific Conductivity	Silica (SiO <sub>2</sub> )
Chloride (Cl)	Sodium (Na)
Fluoride (F)	Mercury (Hg)

approved for ultraclean analysis of water). Three samples were collected from the same locations as the water quality profiles and were thoroughly mixed using a churn splitter. The mixed water was then poured into two sets of water sample containers (one set was retained as a backup in case of shipping or analysis error). The water sample containers each contained the appropriate preservative (if required) and were immediately placed on ice. Samples were kept on ice until and during shipment to the lab for analysis. All sampling equipment were thoroughly cleaned between sites including a bath in 5% HCl and rinse in distilled water. In addition, the sample containers were rinsed with water from the site prior to sample collection. Of the water quality parameters analyzed from these water samples, many have the potential to substantially impact the health and success of native fishes in backwater habitats. Selenium is the only analyte used in the rating sheet, however elevated levels of analytes will be noted and taken into consideration for site selection.

Two other components of the water quality component of the rating classification system for backwaters are the percent composition of cyanobacteria among algae collected near the water surface and the concentration of chlorophyll *a* from the same samples. These data were collected in the same manner as the water samples, using the same gear and sampling in the same areas at approximately 20 cm below the water surface. However, these data were collected within 2 hours of sunrise at each site. The samples were stored in 500-mL, amber-colored polyethylene bottles and preserved with approximately 5% glutaraldehyde immediately after

collection. The samples were stored on ice until and during shipment to the laboratory for analyses.

## **Spawning Habitat**

The second component of the classification model was a measure of the cover available to fishes at the site and included two categories, proportion of total area of a site with water depth of less than 5 ft and proportion of the shoreline with gravel substrate.

Water depth was measured using one of two methods at each site. Where possible an echosounder (Hydrolite) and Global Positioning System (GPS) capable of differential correction (Trimble ProXH) were attached to a jon boat to simultaneously record water depth and position of the transducer while motoring across the pond. Transect spacing was selected in the field based on size of the pond and contours of the substrate to provide a dense coverage of points sufficient to adequately develop a bathymetry map at 1-ft contour intervals. Individual depths were recorded by the echosounder unit every 1 m of distance traveled. This method provided an opportunity to collect extensive datasets in a relatively short period of time. However, this method was greatly affected by the presence of submergent vegetation because of the frequency of the echosounder used (200kHz) and the tendency of the beam to bounce off vegetation, which resulted in inaccurate depth estimates. Where problems were anticipated due to vegetation, we measured depth manually at regularly spaced intervals and correlated each depth measurement with a GPS coordinate collected on the Trimble ProXH unit. This method was more time consuming and resulted in fewer overall points per site, but we were able to generate bathymetry maps from each of these sites that are sufficient to differentiate 1-ft contour intervals and provide the means to estimate area of critical depths for the rating classification. Because many of the sites had large areas with submergent vegetation present, this latter method was used more often over the 25 sites.

Associated with the collection of depth and GPS data to generate the bathymetry, we installed a semi-permanent benchmark adjacent to each site to determine relative elevation of the water surface at the time that bathymetric data were collected (Appendix A lists coordinates of all benchmark locations). The benchmarks were installed close to the shoreline in areas that allowed enough space to set up a survey level and collect data over the benchmark and at the water surface. The elevation difference between the benchmark and water surface was collected at each site with a survey level at the time of the bathymetric data collection.

Each of the sites evaluated during this inventory were originally delineated using aerial photography that was flown in 2004 during approximately the same time of year as these evaluations (August); however, there were some differences observed in the open water area of several sites when data were collected in the field. Much of this difference was likely due to inter-annual variation in water level and potential changes in site characteristics in the intervening 3-year period. We also focused on collecting bathymetry data only in open water areas that were accessible by boat during field efforts, but in some cases were able to maneuver

into sparse emergent vegetation that may have been characterized differently during the aerial photo interpretation and digitizing efforts.

Depth and location data were filtered and differentially corrected to produce high accuracy maps. Depth data were filtered by evaluating change in depth between consecutive points collected by the echosounder or from manually collected water depth. When the change between points was greater than 2 ft, the two points were evaluated (visually on the map and relative to points collected prior and subsequent to the points in question) to determine whether the rapid change in depth appears reasonable (e.g., the point is located along the shoreline where steep banks were common and subsequent points remain shallow). If the point in question occurred in the open water portion of the site and the points did not appear consistent with a rapid change that was sustained over several subsequent points then the point was considered erroneous (usually a result of vegetation, tree, or other structure deflecting the echosounder beam or mislabeled manually collected water depth) and deleted. Any change in depth less than 2 ft was not considered substantial enough to justify deleting the point due to the natural variation that was present in the depth data and the likelihood of inadvertently deleting several valid data points. The method of interpolation should have been sufficient to reduce the undue influence of erroneous individual points that deviated by less than 2 ft on the resulting bathymetry map. The location of each depth point (collected by either means) was corrected to the greatest horizontal accuracy achievable by post-processing the GPS data. Once filtered and corrected, the location and depth of each point was then used to generate a raster image of the substrate elevation using a standard inverse distance-weighted interpolation using the Spatial Analyst extension for ArcGIS (ESRI, Inc. 2005). The Spatial Analyst extension generated 1-ft contour intervals, which were used to calculate the proportional area of each critical depth value (less than 5 ft and greater than 10 ft deep).

Substrate composition is the second category within the spawning habitat component of the rating classification. The percent composition of gravel around the perimeter of each site was estimated as a proportion of individual samples conducted within 10 m of the shoreline. To collect these data, a sounding pole was used to determine substrate class in 1-m increments from the shore out toward the middle of the pond on each of several evenly spaced transects. The total number of transects was determined by size of the backwater (Table 2). When a sample point was too deep to sample with a 10-ft sounding pole, no data were recorded for that point. Substrate classes included sand/silt, gravel, and cobble/boulder. The proportion of each substrate type around the perimeter of the site was determined as the proportion of a class among all sampled points. In addition to substrate characterization around the perimeter of each site for the rating classification, we also collected information on substrates in the open water portion of each lake, specifically identifying any locations where there were larger substrates than sand or silt.

**Table 2. Number of substrate transects was determined by size of backwater being evaluated.**

BACKWATER SIZE	NUMBER OF TRANSECTS
1–5 acres	20
6–10 acres	25
11–15 acres	30
16–25 acres	35
26–40 acres	40

## Cover

Cover for native fishes was measured using four categories: vegetation, turbidity, the presence or absence of small boulder or larger substrates (at least 250 mm), and the proportion of the site with water depth of greater than 10 ft. The abundance of vegetation was originally to be estimated as total surface area of a pond covered with submergent or emergent vegetation of any species. However, the emergent vegetation was common and abundant at all sites and was difficult to map or estimate in the field. As a result, vegetation estimates are based on the percentage of submergent vegetation in the open water portion of each site. The coverage was estimated either visually (when the coverage was clearly <10% or >60% coverage, each of which receives the lowest suitability value in the classification model), or by mapping with a GPS unit, or hand-drawing polygons on a hard-copy map of the site. At times, high turbidity and/or deep sites made direct observation impossible and a rake was used to determine the extent of the submergent vegetation. When mapping with the GPS unit was needed, the Trimble ProXH unit was used to collect point and line data around the perimeter of each vegetation patch. Data were later differentially corrected and converted into polygons for calculation of total vegetation coverage. The vegetation coverage data were then used to determine the proportion of vegetation coverage relative to the total surface area of the pond.

Turbidity data (measured as Nephelometric Turbidity Units [NTU]) were collected as one of the parameters associated with the three water quality profiles. An average turbidity value was calculated at 1 m below the water surface among the three profiles (values at a 0.5-m depth were used when total water depth was 1 m).

The presence or absence of small boulders was determined through visual observations of substrate composition (approximately 250 mm or larger). The collection of water depth data is described above in the section on spawning habitat.

## Bio-Indicators

The final component of the rating classification was the presence or absence of bio-indicators. The presence of fish of any species (except *Gambusia* sp. and bullhead) was considered a positive biological indicator of current habitat conditions in a site. If other fish species can persist in a site then the habitat would likely be able to support native fishes with certain habitat creation efforts. Though a positive result is not indicative that native fish would be able to survive in the habitat if introduced without further action, this observation suggests that such a site already has basic habitat characteristics that are commonly required by many fish species.

The fish community was sampled using one to three trammel nets (50-m long, 2-m tall, and 1-in mesh size) and minnow traps (20.5-in-long steel-wire cylinders with a total diameter of 8.5-in, a throat diameter of 1.5-in, and a mesh size of 1.25-in). Nets were deployed prior to 8:00 a.m. (only one trammel net was deployed at any site in the morning to minimize the chance of retrieving nets during the hottest part of the day) or after 6:00 p.m. In most instances, the nets were checked within 2–3 hours. If 10 or more individual fish of any species (excluding *Gambusia* sp. or bullhead) were captured, then no further netting occurred and the site was scored as having fish present. If fewer than 10 fish were captured, then one to three trammel nets were set after 6:00 p.m. and retrieved before 8:00 a.m. the following morning.

## Scoring

Site scores were developed using the rating system described in Reclamation (2007). A score was assigned to each category within each of the four primary rating components and all scores summed to achieve the final biological suitability criteria score and habitat creation opportunity rating. The maximum possible score is 75; 40 for water quality, 10 for spawning habitat, 20 for cover, and 5 for bio-indicators. Based on the overall score for a site, a habitat creation opportunity rating of excellent, high, moderate, or low was assigned to each site (Table 3).

**Table 3. Site scores are used to determine habitat creation opportunity ratings.**

HABITAT CREATION OPPORTUNITY RATING	SCORE
Excellent	60–75
High	52–59
Moderate	45–51
Low	<45

In addition to the data collected to meet the requirements of the classification system for determining habitat creation opportunity ratings, additional data were collected that might be useful in the process of selecting potential sites, either biologically or with regards to restoration

logistics. These data included connectivity with the river, area of open water, channel formation type, backwater size, shoreline development index (SDI) value, observations on water exchange, unique cover features, unique riparian vegetation characteristics, and any other relevant observations. Backwater size was determined in advance with aerial photography and modified, when necessary, by field data. The perimeter of the backwater, determined from aerial imagery and field data, was then used to calculate the SDI value, which is the ratio of the length of the shoreline to the circumference of a circle of area equal to that of the lake. Thus, the SDI value indicates how much the surface area of a site deviates from perfectly round with higher values likely resulting in higher diversity of habitat features available to fish.

## **SUMMARY OF RESULTS**

### **Scoring**

The results for each site will be discussed individually; however, some general observations and a summary are provided below. All sites were observed to be floodplain lakes with no other obvious indication of their formation history (e.g., an oxbow lake).

Of the 25 sites evaluated in this effort, 3 rated as having low, 2 as having moderate, 11 as having high, and 9 as having excellent habitat creation opportunity (Table 4; Appendix B). It was anticipated that scoring may be strongly influenced by the current connectivity of the site to the river, with isolated sites scoring more poorly. However, seven of the nine sites that were identified as isolated rated in the high or excellent categories and four of the six sites rating as low or moderate were directly connected to the river. The recognition of truly isolated sites was complicated by dense growth of emergent vegetation around each site. Where it may appear that a solid berm separated the site from the river, it is possible that small channel may have gone undetected through the dense vegetation. In many cases, sites that were considered isolated from field observations had water quality conditions that indicated some hydraulic connection with the river. Many of these sites would likely be classified as pseudo-seeps by Prieto (1998), whereas it appears from water quality data that only a few true seeps were evaluated in this process.

### **Water Quality**

Site scores for water quality ranged from a low of 21 to the maximum of 40. Only four sites had scores below 30, three of which were the three sites with low habitat creation opportunity ratings. All sites that had a score of over 35 in this category had ratings of high or excellent, which suggests that this component was highly influential in determining the overall rating for a site. All but three sites received the highest score for specific conductivity (salinity), pH, selenium, chlorophyll *a*, and cyanobacteria, so most of the variation among sites was in temperature and DO concentration.



**Table 4. Biological suitability scores for each site by individual component; the scores were used to assign habitat creation opportunity ratings.**

SITE	WATER QUALITY	SPAWN HABITAT	COVER	BIO-INDICATORS	BIOLOGICAL SUITABILITY SCORE	HABITAT CREATION OPPORTUNITY RATING
A69.7c	38	6	6	5	55	High
A67.9	38	2	10	5	55	High
C67.6a	29	2	6	5	42	Low
C67.6b	38	10	6	5	59	High
A67.5	27	6	6	5	44	Low
C65.0	38	10	14	5	67	Excellent
A64.5	25	10	16	5	56	High
C64.4	38	10	6	5	59	High
C64.1	36	6	6	5	53	High
C63.8	38	10	10	5	63	Excellent
A63.7	36	10	8	5	59	High
C62.9	38	10	6	5	59	High
A62.3	38	10	18	5	71	Excellent
A59.7	38	2	10	5	55	High
C57.6a	38	6	6	5	55	High
C57.6	21	2	8	5	36	Low
A55.4	33	2	8	5	48	Moderate
A54.3	40	6	10	5	61	Excellent
C53.5	38	10	10	5	63	Excellent
A53.4	38	10	14	5	67	Excellent
C52.5	40	10	14	5	69	Excellent
A51.4	38	10	14	5	67	Excellent
A49.2	38	10	10	5	63	Excellent
C48.5	33	6	6	5	50	Moderate
C48.2	36	6	6	5	53	High

Among water quality parameters evaluated from water samples, most results were not within a range that would cause concern for the ability of a site to support native fishes (Appendix C). Notably, selenium and mercury were well below any level of concern; in only one case did the concentration exceed the detection limit (mercury in site C67.6a measured 0.0008 mg/L).

Nitrogen (measured as TKN and Nitrate-Nitrite) was low in all sites and phosphorus was also low in all sites except C48.2 and C57.6a, where measurements of 9.5 and 16.0 mg/L were collected, respectively.

Many of the water quality results were very similar among sites, but distinct exceptions occurred. The most clearly isolated sites observed during field efforts were C57.6 (pools A, B, and C), C48.5 (West Pond), C48.2 (Horseshoe Pond), and A49.2. In addition, C57.6a (Ferguson Lake) had a connection to the river but the site was situated more than 3 km upstream from the direct connection to the river which limits the ability of water to flow to and from the river. In effect, this site was more hydraulically disconnected from the river than many other sites with open channels for access. The results of water samples generally revealed the distinction between these sites and all of the others. For instance, sodium measured within a range of 110–130 mg/L for most sites, but was higher in C57.6a (220 mg/L), C57.6 (260–370 mg/L in the 3 pools), C48.2 (260 mg/L), and C48.5 (300 mg/L). The highest value was recorded in A49.2 (500 mg/L). Another example was total organic carbon which measured between 2.5–5.0 mg/L for most sites, but Horseshoe Pond was higher at 5.7 mg/L. Organic carbon was 9.4 mg/L at Ferguson Lake, 9.8 mg/L at West Pond, and 17.0–26.0 mg/L at the 3 pools of C57.6. The often drastic differences between these isolated sites and the others highlight the influence of a complete separation from the river (true seeps).

## Spawning Habitat

Five sites received the lowest possible score for spawning habitat (2 points), 1 point each for the “depth less than 5 ft” category and for proportion of gravel substrate along the shoreline. A score of one in the former category occurred not because there was too little habitat available for spawning, but because too much habitat is shallow and would likely lead to rapid eutrophication and succession of the site. In seven instances, a score of six was received, in all cases due to excessive shallow habitat rather than a limitation on gravel availability.

## Cover

Cover scores ranged from 6–18, with no site receiving the maximum of 20 points. The presence of emergent vegetation in the form of dense cattail (*Typha domingensis*) and water reed (*Phragmites australis*) was ubiquitous; however, there was great variation in submergent vegetation among sites. Several sites had nearly 100% coverage (usually spiny naiad) while others had virtually no submergent vegetation at all. Seventeen out of the 25 sites did not have vegetation coverage within the 10–60% range required to receive the maximum score. Turbidity was most commonly in the moderate suitability range of 1–10 NTU or 100–150 NTU and these sites received 3 points. Only 4 sites had turbidity in the high suitability range of 10–100 NTU to receive 5 points. Boulders were surprisingly observed in 9 of the 25 sample sites. Areas with boulders were associated with rocky shorelines that extended into the water, with some large substrates available for cover. Some sites were observed to have relatively small amounts of boulder substrate (e.g., a single pile or a few small, dispersed piles) that would provide limited

cover to a few individual fish. However, no minimum quantity was specified in the rating system and these sites officially qualified for the higher score. The true benefit of these features as suitable cover for native fish species may not have been as extensive as originally intended for the rating process and this characteristic should probably be further evaluated in seasonal monitoring to establish whether the presence of this substrate material is sufficient to warrant giving the site a higher score for the cover component of the classification. Finally, only two sites had greater than 15 % area with depths of 10 ft or more (none more than 35 %). Most of the sites evaluated in this effort were floodplain depressions that are not likely to have been very deep initially, and have presumably become more shallow as vegetation annually senesces and contributes organic detritus to the substrates. The lack of connection between these floodplain lakes and the river prevents flushing flows that occurred historically and has allowed the organic debris to accumulate.

## Bio-Indicators

Fish (other than *Gambusia* sp. or bullhead [*Ameiurus* sp.]) were captured in each site so that all received a score of five for this component. In most sites, several fish species were captured, included redear sunfish (*Lepomis microlophus*), bluegill sunfish (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), common carp (*Carpionides carpio*), threadfin shad (*Dorosoma petenense*), and warmouth (*Lepomis gulosus*). No LCR MSCP-covered fish species were captured. The one site that did not appear to have any fish other than *Gambusia* sp. was C57.6, which had DO levels below 1 mg/L throughout the water column. At this site, we captured one common carp that died while in the net.

## Other Observations

All sites were considered floodplain depressions with varying connectivity to the river. Several sites had no obvious surface connection, yet water quality data suggested conditions that were similar to the river. In such cases, a more thorough investigation of hydraulic connectivity between the river and the backwater should be conducted before initiating habitat creation efforts that are designed to prevent the occurrence of non-native fish. The shoreline development index (SDI) values for all sites (an indicator of the shape of the pond) ranged from 1.19–5.23 (A69.7c and A59.7 (Headquarters Lake), respectively)(Table 5). Twenty-one sites have SDI values below 3.0. These would have been classified as having low (1.0–2.0) or moderate (2.0–3.0) shoreline complexity according to Holden et al. (1986). The four sites with SDI values greater than 3.0 would have been classified as having high shoreline complexity. As previously mentioned, all sites had dense stands of cattails and water reed along the shoreline and most sites also had numerous standing tree trunks in the water column, both of which increase habitat complexity and provide cover. However, the negative aspect of such complex habitat characteristics (primarily the dense emergent vegetation) is the difficulty this presents if sites are to be treated to remove non-native fish species prior to introduction of native fish species. Complex habitat provides numerous refuge locations and limits the effective dispersal of the treatment applied to the site.

**Table 5. Area and SDI value of each site evaluated in reaches 5 and 6.**

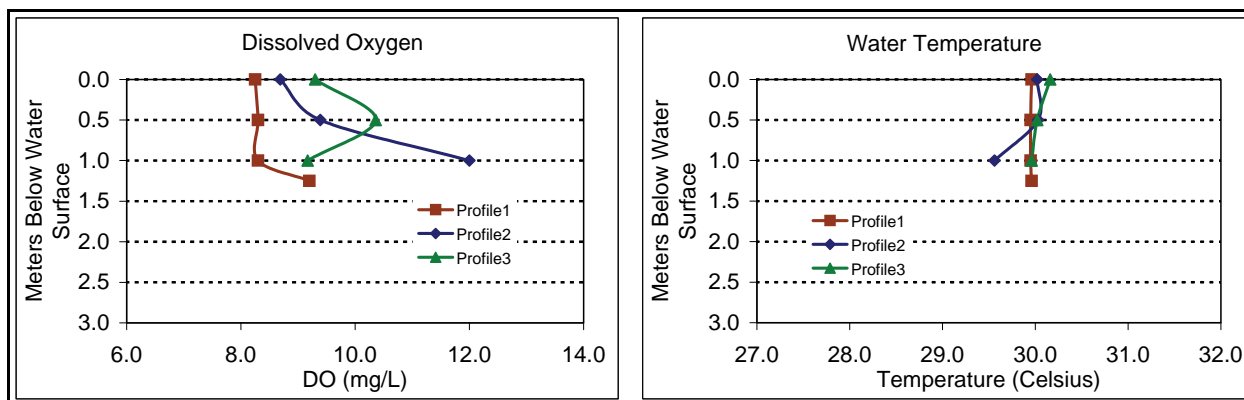
<b>LAKE</b>	<b>SURFACE AREA</b>	<b>SDI</b>
A69.7c	2.4	1.19
A67.9	27.6	3.57
C67.6a	3.2	1.53
C67.6b	4.6	1.53
A67.5	2.2	1.33
C65.0	17.5	2.88
A64.5	4.3	1.24
C64.4	7.8	2.31
C64.1	3.8	1.49
A63.8	4.8	1.85
A63.7	17.4	2.16
C62.9	35.2	2.95
A62.3	11.2	1.64
A59.7	18.2	5.23
C57.6a	28.5	3.87
C57.6	16.4	4.37
A55.4	14.5	2.16
A54.3	4.9	1.56
C53.5	5.6	1.34
A53.4	5.2	2.54
C52.5	7.1	2.05
A51.4	10.8	2.45
A49.2	10.1	1.73
C48.5	50.2	2.28
C48.2	4.9	1.98

## SITE-SPECIFIC RESULTS

### A69.7c - High Rating

Site A69.7c is 2.4 acres and was directly connected to the Colorado River via a small channel. Some standing tree trunks were observed during the field visit, but fewer than observed in many other sites. With an SDI value of 1.19, this site has much lower shoreline complexity than many other sites evaluated during this effort.

The total biological suitability criteria score for this site was 55, which gives it a high habitat creation opportunity rating. Water quality was very good with an average DO value of 9.4 mg/L, specific conductivity of 1146  $\mu\text{S}/\text{cm}$ , and a chlorophyll *a* concentration of less than 1.0 mg/L. Water temperature was 30.0°C, which is likely a result of the shallow nature of this site (mean depth was 4.9 ft). More than 50% of the total area was more shallow than 5 ft (82%) and no habitat was deeper than 10 ft, which resulted in a low score in each of these categories. Water quality data collected over 24 hours had a DO concentration range from 6.1 to over 12.0 mg/L and a water temperature range from 27.2–31.0°C. There was slightly too much vegetation (65.9%) to qualify for the high score, which may result in a large fall die-off and potential oxygen depletion in the near term and high contribution to sedimentation and eutrophication over a longer time scale. No temperature stratification was apparent at this site from the profile data (Figure 2).



**Figure 2. Water quality profile data for site A69.7c.**

Several potential problems exist at site A69.7c that may prohibit it from providing long-term habitat for razorback suckers and bonytail (Figure 3). Site access is limited because the site is in a wilderness area, as noted in LCR MSCP (2007b). The relatively high abundance of submergent vegetation likely contributes to the high DO concentration observed during the summer, but may lead to low DO problems during a fall die-off. There appears to be no limitation to available spawning habitat, but the overall shallow conditions may lead to

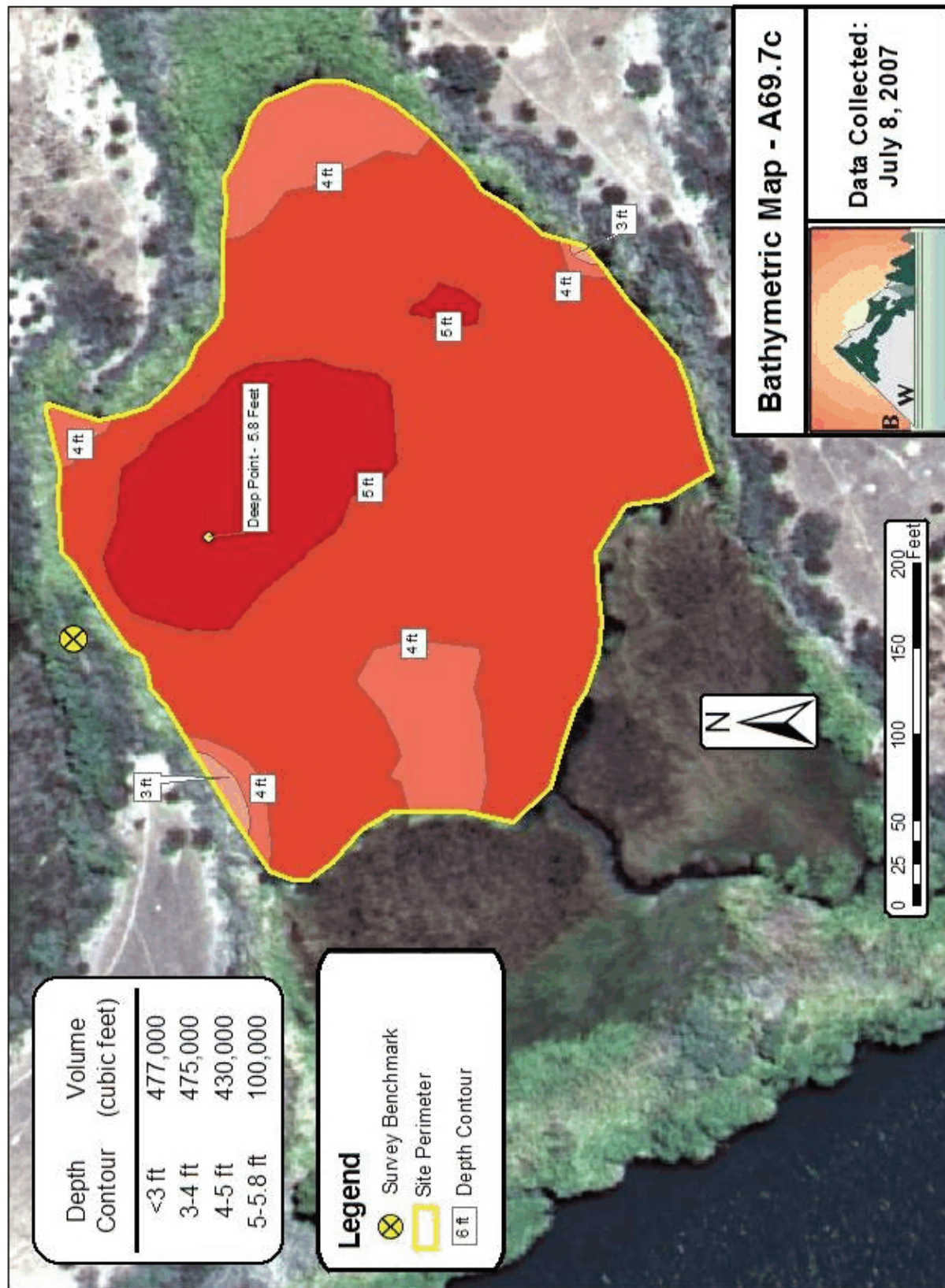


Figure 3. Bathymetric map of site A69.7c.

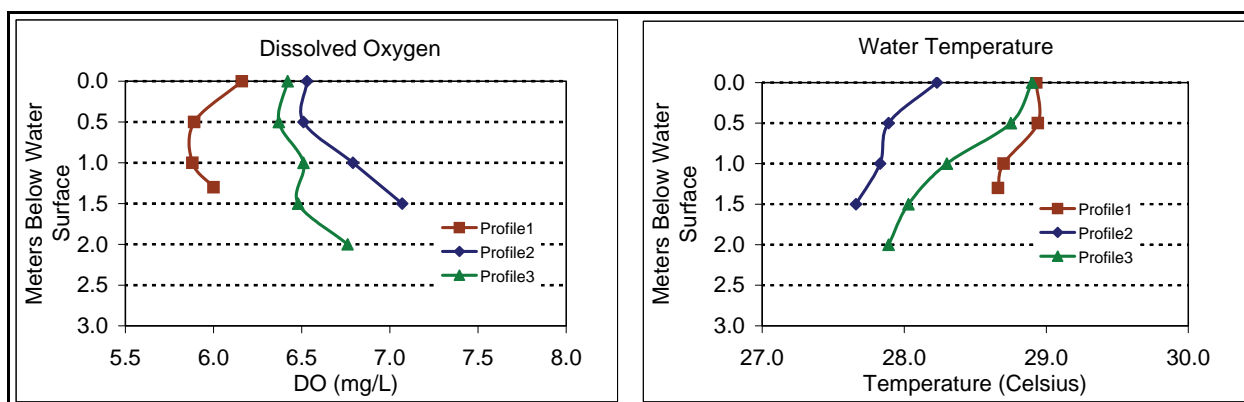
long-term problems with temperature and potentially a lack of suitable refuge from avian predators. Also, as with any site that is currently connected to the river and may be hydraulically isolated, changes in water quality conditions cannot be accurately predicted. Post-isolation monitoring should be conducted to determine whether water quality characteristics would remain within suitable ranges for native fish.



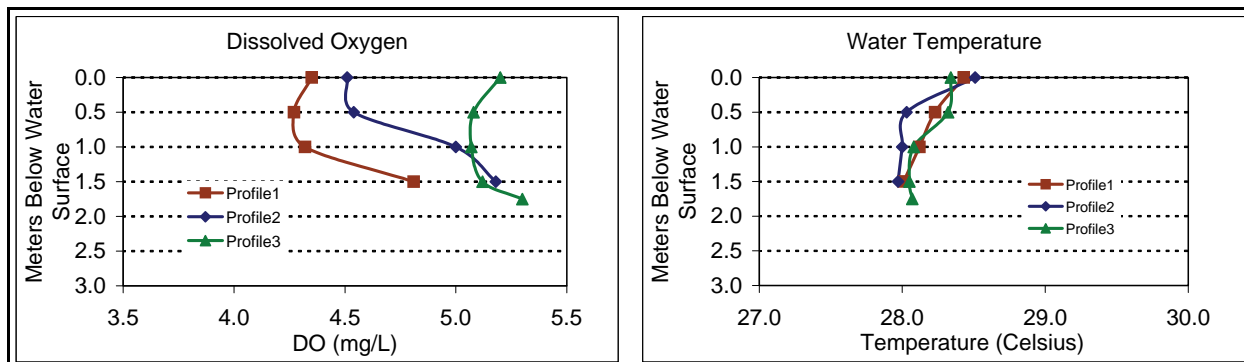
## A67.9 (Hidden Lake) - High Rating

Site A67.9 included two pools (A and B) and was originally delineated at 28.8 acres, but after collecting bathymetric data, the adjusted site dimensions resulted in an area of 27.6 acres. The two pools were found to be directly connected to one another as well as to the Colorado River during field data collection. Many standing tree trunks were observed and in many places, there appeared to be undercut banks, but the dense water reed prevented a thorough characterization of these features. With an SDI value of 3.57, this site has one of the highest shoreline complexities among all sites evaluated during this effort.

The total biological suitability criteria score for this site was 55, which gives it a high habitat creation opportunity rating. Water quality was very good with an average DO value of 5.6 mg/L, water temperature of 28.1°C, specific conductivity of 1117  $\mu\text{S}/\text{cm}$ , and a chlorophyll *a* concentration of less than 1.0 mg/L. The profile data revealed no distinct stratification in either pool and DO remained within a range of 4.0–5.5 mg/L in the smaller, more isolated pool (B) and approximately 6.0–7.0 in the larger pool (A) (Figures 4 and 5). The 24-h water quality data was collected in the larger pool and DO ranged from 5.9–7.8 mg/L and temperature ranged from 27.7–29.0°C.



**Figure 4. Water quality profile data for site A67.9 Pool A.**



**Figure 5. Water quality profile data for site A67.9 Pool B.**

Mean depth of the site was 5.1 ft and 51.7% of the total area was more shallow than 5 ft (Figure 6). The proportion of gravel (4.8%) was also close to the threshold between high and low suitability. Had both of these factors been slightly different, the site would have been rated among the excellent habitat creation opportunity sites.

This site appears to be a very good prospect for habitat creation, despite rating as high rather than excellent. Both categories in the spawning habitat component of the rating system are very close to being within the high suitability range and water quality appears to be very good overall. Although the lack of submergent vegetation may limit the cover available to native fishes, this would also limit the prospect of large swings in DO concentration resulting from fall vegetation die-offs. The site also has high shoreline complexity and numerous standing tree trunks, which may offset the limited vegetative cover to some extent. In addition, a potential solution to limited vegetative cover may be to manually increase cover (such as adding boulders). As with any site that is currently connected to the river and may be hydraulically isolated, changes in water quality conditions cannot be accurately predicted. Post-isolation monitoring should be conducted to determine whether water quality characteristics would remain within suitable ranges for native fish.

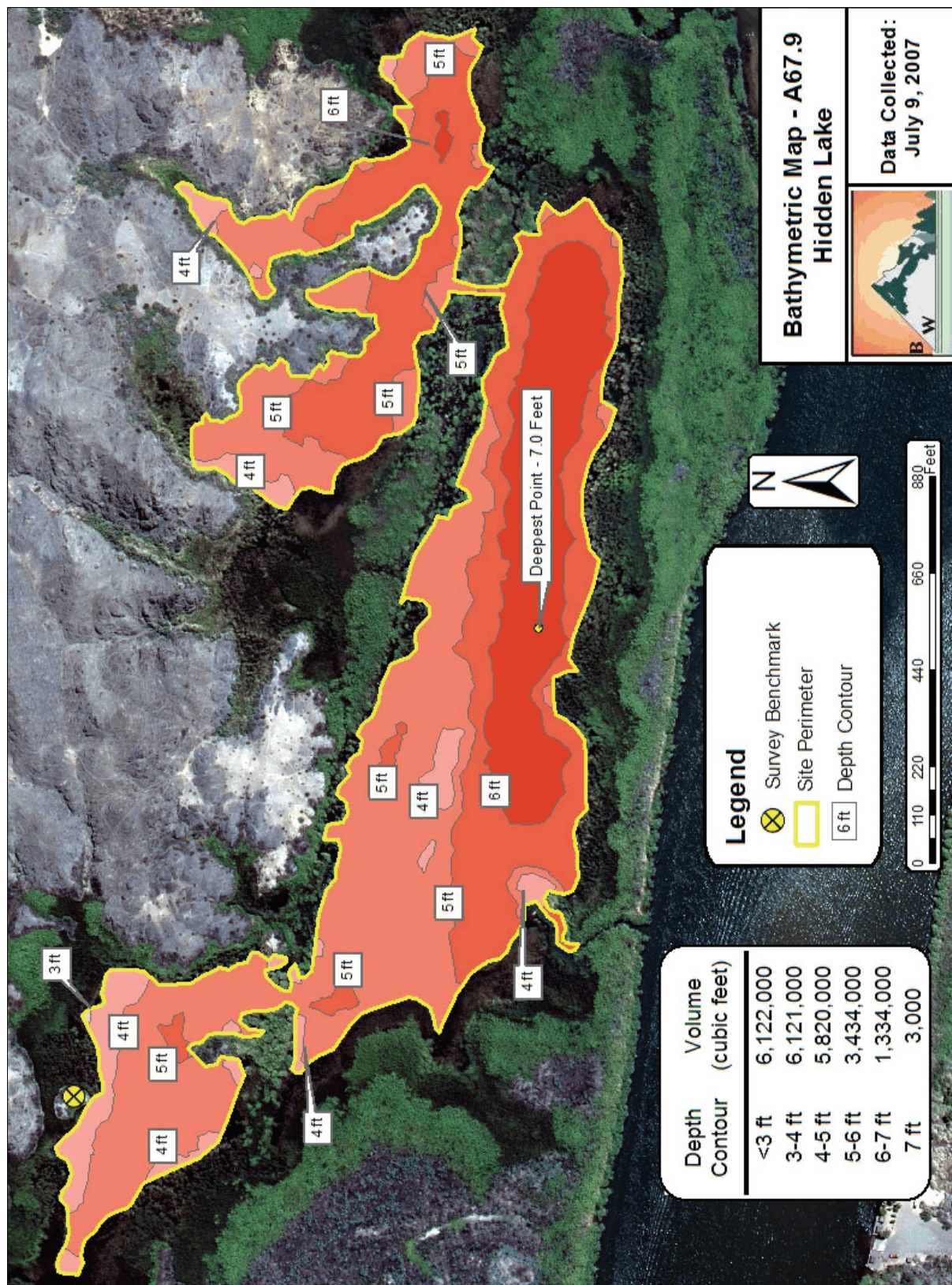


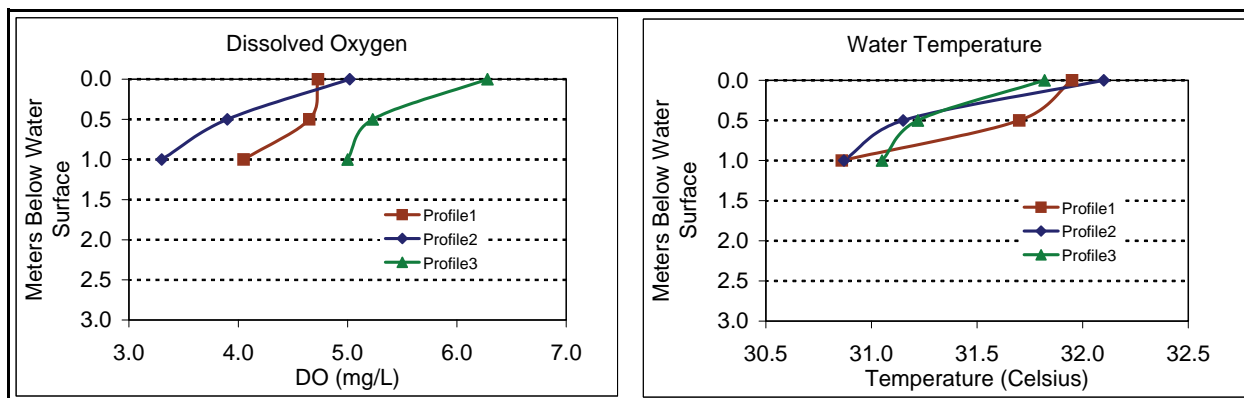
Figure 6. Bathymetric map of site A67.9.



## C67.6a - Low Rating

Site C67.6a was originally delineated at 4.1 acres, but after collecting bathymetric data, the adjusted site dimensions resulted in an area of 3.2 acres. Many standing tree trunks were observed as well as a beaver dam in the channel that connected the site to the Colorado River. The SDI value of 1.53 indicates relatively low shoreline complexity.

There were many components that led to the low biological suitability criteria score of 42 for this site, which gives it a low habitat creation opportunity rating. Average DO concentration was in the intermediate suitability range at 4.6 mg/L, water temperature rated low in suitability at over 31°C; over a 24-h period, DO ranged from 2.2–4.8 mg/L and temperature ranged from 29.2–31.4°C. This site also rated low on both components of spawning habitat due to 100% of the site being less than 5 ft deep (mean depth was 3.8 ft) and too little gravel on the shoreline (3.5%). This site also had virtually zero submergent vegetation, low turbidity, no boulders, and no area greater than 10 ft in depth to provide cover. The profile data revealed a difference of about 1.0°C between the surface and bottom (approximately 1 m) and a DO decline of over 1 mg/L on average among the three profiles (Figure 7).



**Figure 7. Water quality profile data for site C67.6a.**

Figure 8 provides an overview map of site C67.6a. This site has several potential problems that may limit habitat creation opportunities. This site is very shallow, which has resulted in higher temperatures than many other sites. There is also a distinct lack of vegetation and limited cover available to native fishes. These problems are not insurmountable; however, this site would likely require dredging to provide a thermal refuge and addition of some form of cover and gravel for spawning. Also, as with any site that is currently connected to the river and may be hydraulically isolated, changes in water quality conditions cannot be accurately predicted. Post-isolation monitoring should be conducted to determine whether water quality characteristics would remain within suitable ranges for native fish.

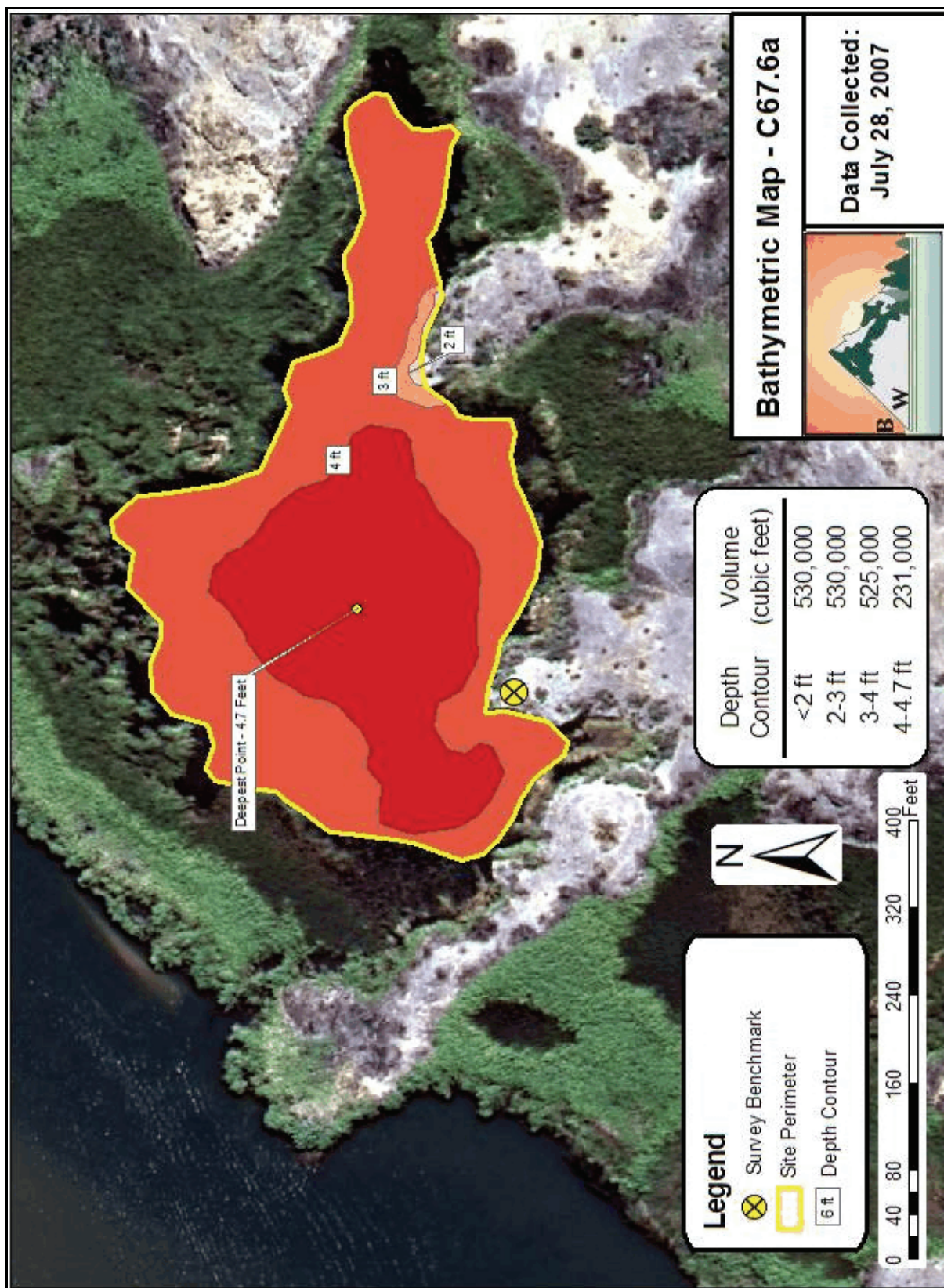


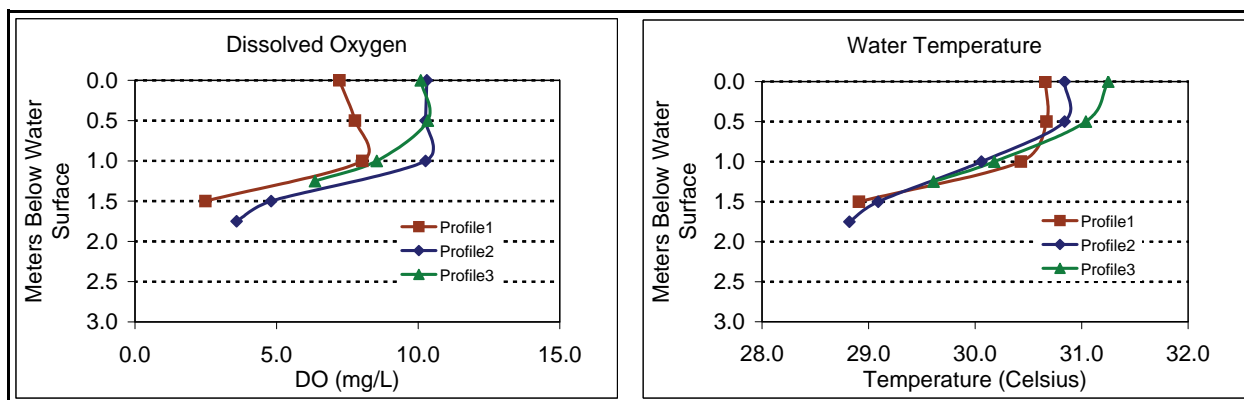
Figure 8. Bathymetric map of site C67.6a.

## C67.6b - High Rating

Site C67.6b is 4.6 acres. This site appeared to be isolated from the Colorado River during the field data collection; however, some of the water quality data suggest that there may be a surface connection that was obscured by dense emergent vegetation. There were many standing tree trunks that may provide some cover to native fishes. With an SDI value of 1.53, shoreline complexity was low at this site.

The total biological suitability criteria score for this site was 59, which gives it a high habitat creation opportunity rating. Water quality was very good with an average DO value of 8.94 mg/L, specific conductivity of 1258  $\mu\text{S}/\text{cm}$ , and a chlorophyll *a* concentration of less than 1.0 mg/L. The only water quality variable that did not rate as highly suitable was temperature at 30.2°C. The 24-h water quality data showed DO had wide diel variation, from 7.6–17.7 mg/L, and temperature remained consistently high (30.3–32.2°C).

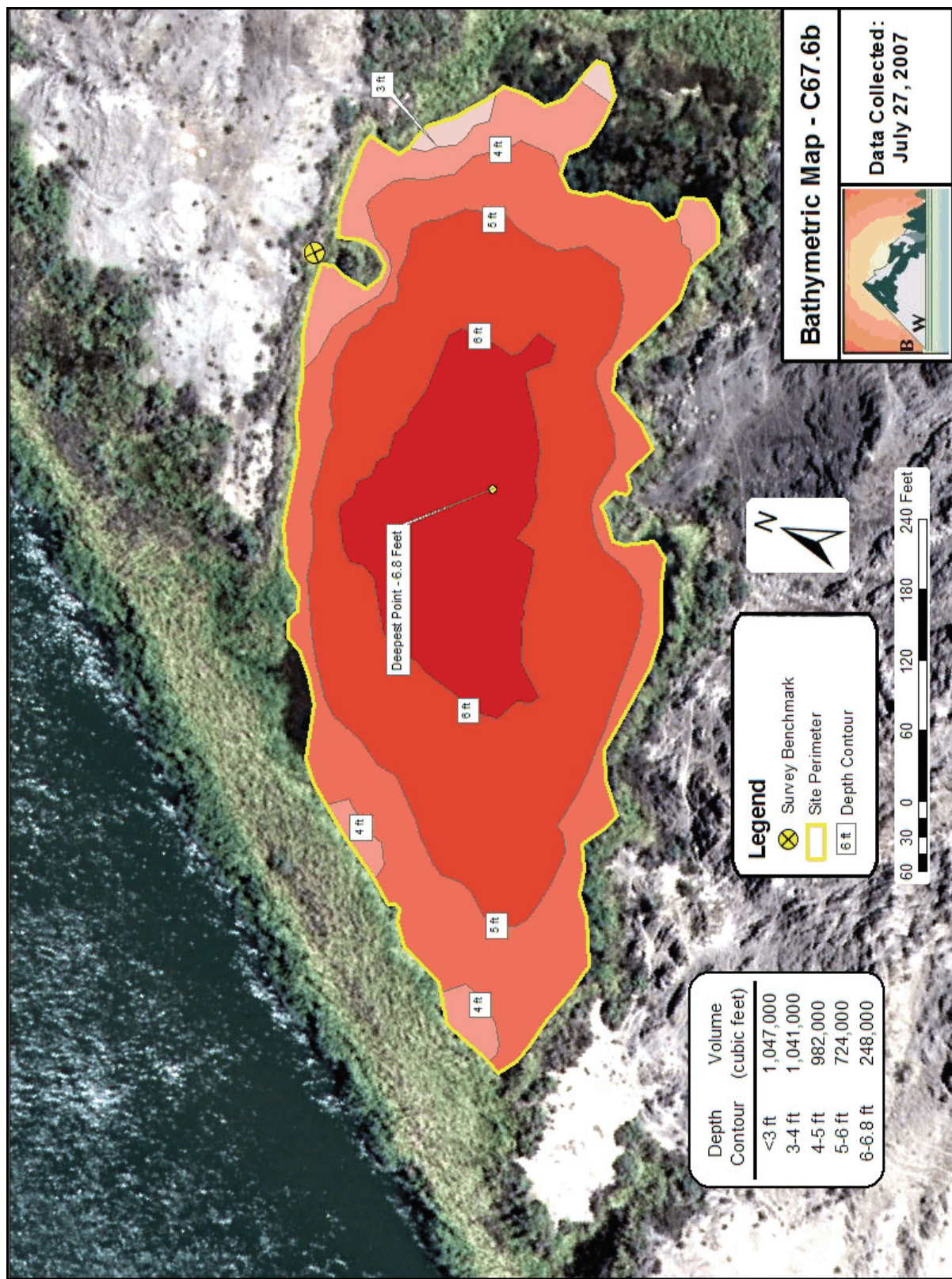
In stark contrast to nearby A67.6a, this site was virtually 100% covered with submergent vegetation (primarily spiny naiad), which is likely a primary factor in the wide diel variation in DO concentration and likely increases heat absorption and dispersal into the water column. Although site C67.6b had no area greater than 10 ft in depth, only one-third of the total area was less than 5 ft in depth (mean depth was 5.2 ft). The profile data revealed a difference of about 2.0°C between the surface and bottom (approximately 1.5 m) and a decline of over 1 mg/L on average among the three profiles (Figure 9).



**Figure 9. Water quality profile data for site C67.6b.**

Figure 10 provides an overview map of site C67.6b. No apparent connection to the river was observed, but water quality, specifically conductivity, suggests good exchange of water with the river. This may be due to an unobserved surface connection or because the site is so close to the river. There may be enough subsurface exchange to account for the good water quality. If the latter, this could be a very good opportunity to work with a site that would have limited exposure





**Figure 10. Bathymetric map of site C67.6b.**



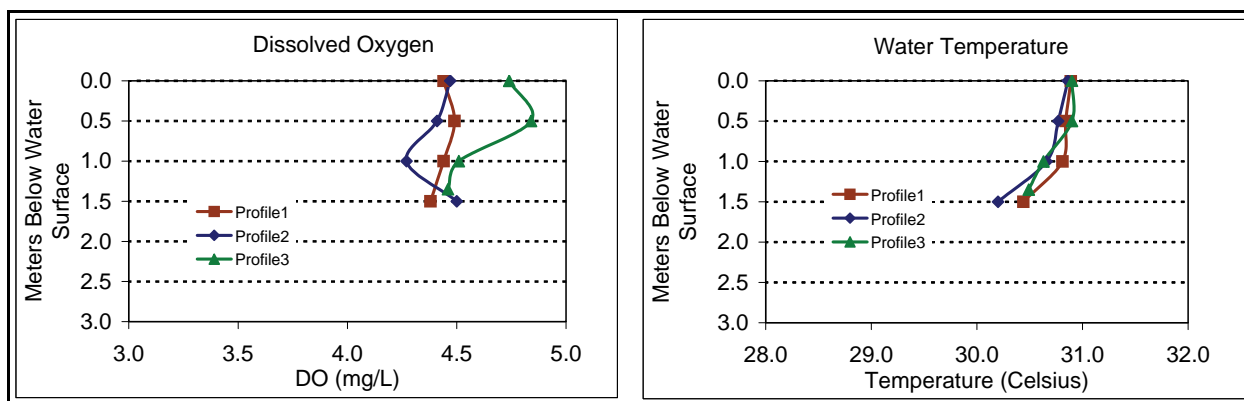
to non-native fish (once the existing populations are removed) and maintain excellent water quality. Prieto (1998) indicates that pseudo-seep sites — which is what this would be classified as with no apparent surface connection — can have specific conductivity values that are close to that observed in the river.

Aside from the issue of establishing whether a surface connection exists, there are some other potential concerns that should be further evaluated. Dissolved oxygen concentration was very high, scoring a 10 of 10 points for that category, but the 24-h data revealed wide swings in the concentration over the course of a single day, which is likely due to the dense submergent vegetation. During the fall, as the abundant spiny naiad senesces, there may be very dramatic changes in water quality, particularly a decrease in DO concentration as the primary source is lost and biological oxygen demand increases substantially. There would also be a dramatic change in cover availability when all of the spiny naiad disappears. Dredging the site may reduce the abundance of vegetation and would likely remove much of the sediment that supports this dense growth (as well as potentially providing a deep refuge of greater than 10 ft), but dredging introduces many logistical difficulties.

## A67.5 - Low Rating

Site A67.5 is 2.2 acres and was directly connected to the Colorado River via a small channel during field data collection. As with most sites there were numerous standing tree trunks that may provide some cover to native fishes. With an SDI value of 1.33, shoreline complexity was low at this site.

The total biological suitability criteria score for this site is 44, which gives it a low habitat creation opportunity rating. Average DO concentration was in the intermediate suitability range at 4.4 mg/L and water temperature rated moderate in suitability at 30.7°C. However, the result that differentiates this site from others is high cyanobacteria counts. The cyanobacteria counts in the sample from this site just crossed the threshold of 50% into the low suitability range. Profile data revealed no stratification throughout the water column (Figure 11). Dissolved oxygen ranged from 3.6–6.1 mg/L over 24 hours while temperature ranged from 28.6–30.4°C. Little vegetation was identified during field data collection and 82% of the area was less than 5 ft deep (mean depth was 4.2 ft).



**Figure 11. Water quality profile data for site A67.5.**

Figure 12 provides an overview map of site A67.5. Similar to C67.6a, another low-scoring site, A67.5 appears to have several potential problems that may limit habitat creation opportunities. This site is very shallow, which has resulted in higher temperatures than many other sites. There is also a distinct lack of vegetation in the site and limited cover available to native fishes. These problems are not insurmountable; however, this site would likely require dredging to provide a thermal refuge and addition of some form of cover. Also, as with any site that is currently connected to the river and may be hydraulically isolated, changes in water quality conditions cannot be accurately predicted. Post-isolation monitoring should be conducted to determine whether water quality characteristics would remain within suitable ranges for native fish.

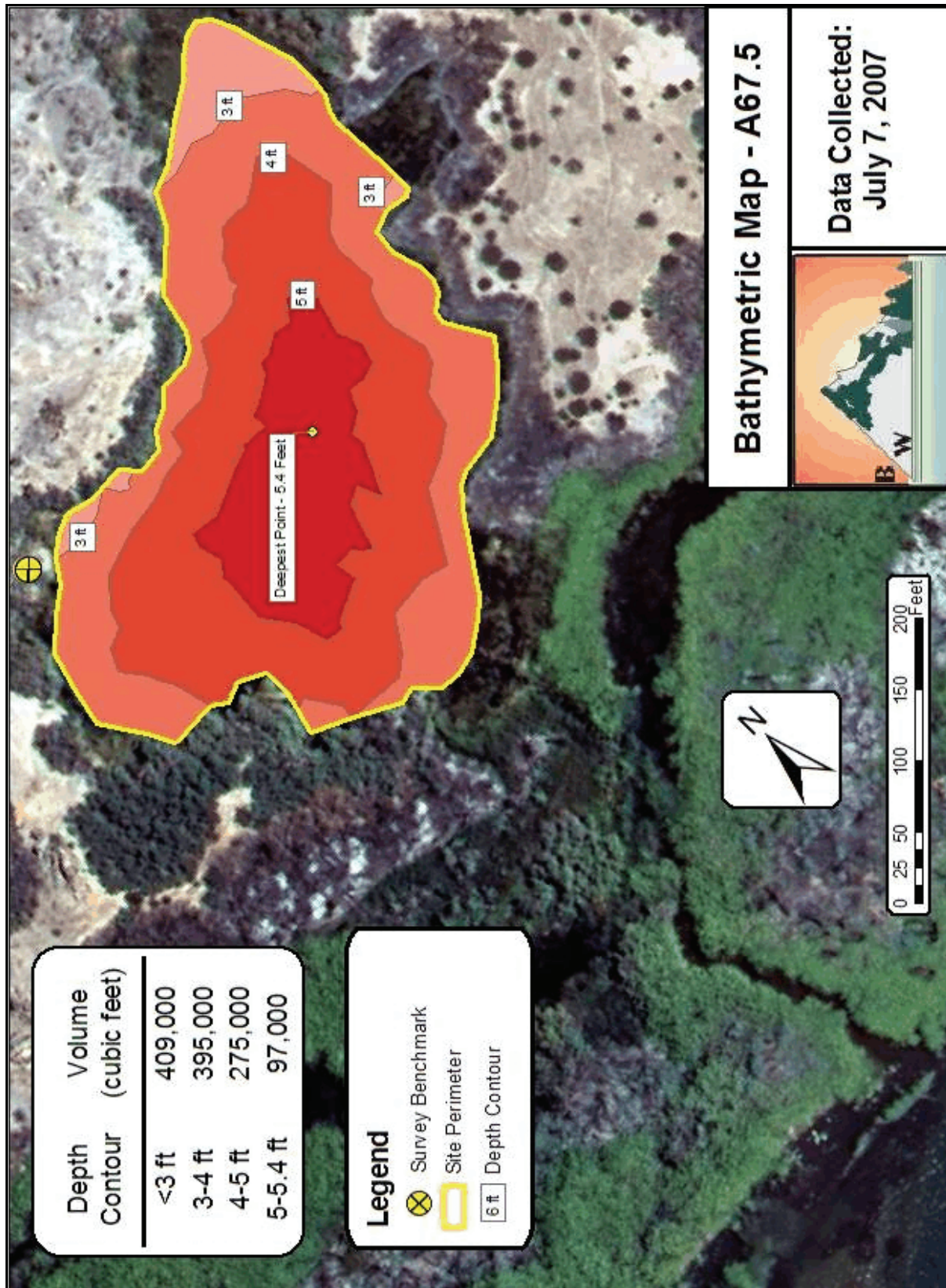
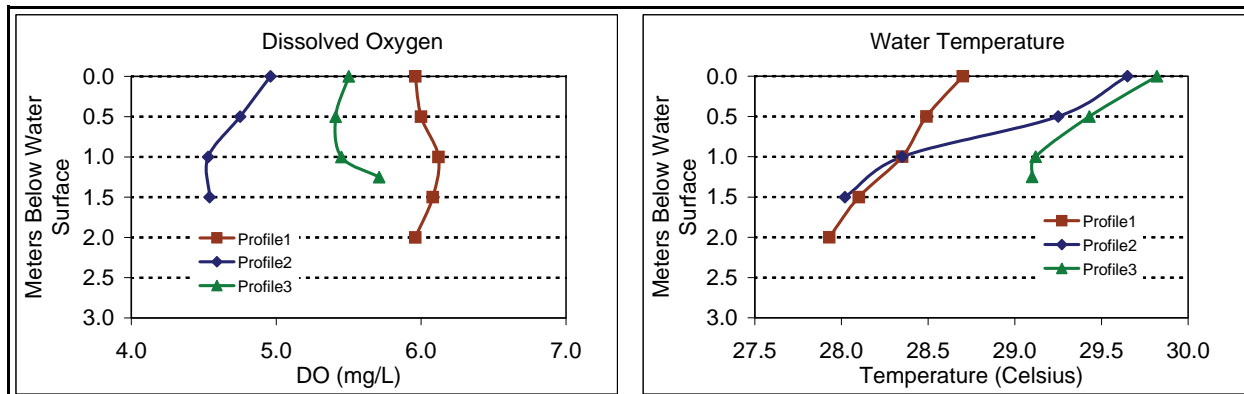


Figure 12. Bathymetric map of site A67.5.

## C65.0 - Excellent Rating

Site C65.0 is 17.5 acres and was directly connected to the Colorado River during field data collection. Noticeably fewer standing tree trunks were observed in this site relative to others. Also notable was that the channel connecting the site to the river was clearly dredged for access but was completely grown over and very difficult to navigate, suggesting lack of recent recreational use. With an SDI value of 2.88, this site has a relatively high shoreline complexity.

The total biological suitability criteria score for this site was 67, which gives it an excellent habitat creation opportunity rating. Water quality was very good with an average DO value of 5.37 mg/L, water temperature of 28.6°C, specific conductivity of 1191  $\mu\text{S}/\text{cm}$ , and a chlorophyll *a* concentration of less than 1.0 mg/L. The profile data revealed no distinct stratification (Figure 13). Over 24 hours, the DO concentration ranged from 3.2–14.3 mg/L and temperature ranged from 27.9–31.4°C.



**Figure 13. Water quality profile data for site C65.0.**

Figure 14 provides an overview map of site C65.0. This site appears to be a very good prospect for habitat creation; however, there are some areas of potential concern. There was great variation in DO concentration over the 24-h sample period, which is likely attributable to the high abundance of submergent vegetation. This factor was one of several that was near the threshold value for suitability. At 57.8%, the coverage of vegetation was very close to dropping from high to low suitability in the rating system. Dissolved oxygen was also just slightly above the threshold of 5.0 mg/L and the percent of gravel substrate was just enough (5.1%) to qualify for the high suitability score. As with other sites that have large variation in DO concentration and high vegetation abundance, there could be seasonal problems with DO. Also, although there was less than 50% of the site that was more shallow than 5 ft, mean depth was just 5.4 ft and there was no deep refuge (greater than 10 ft deep). Finally, as with any site that is currently connected to the river and may be hydraulically isolated, changes in water quality conditions cannot be accurately predicted. Post-isolation monitoring should be conducted to determine whether water quality characteristics would remain within suitable ranges for native fish.



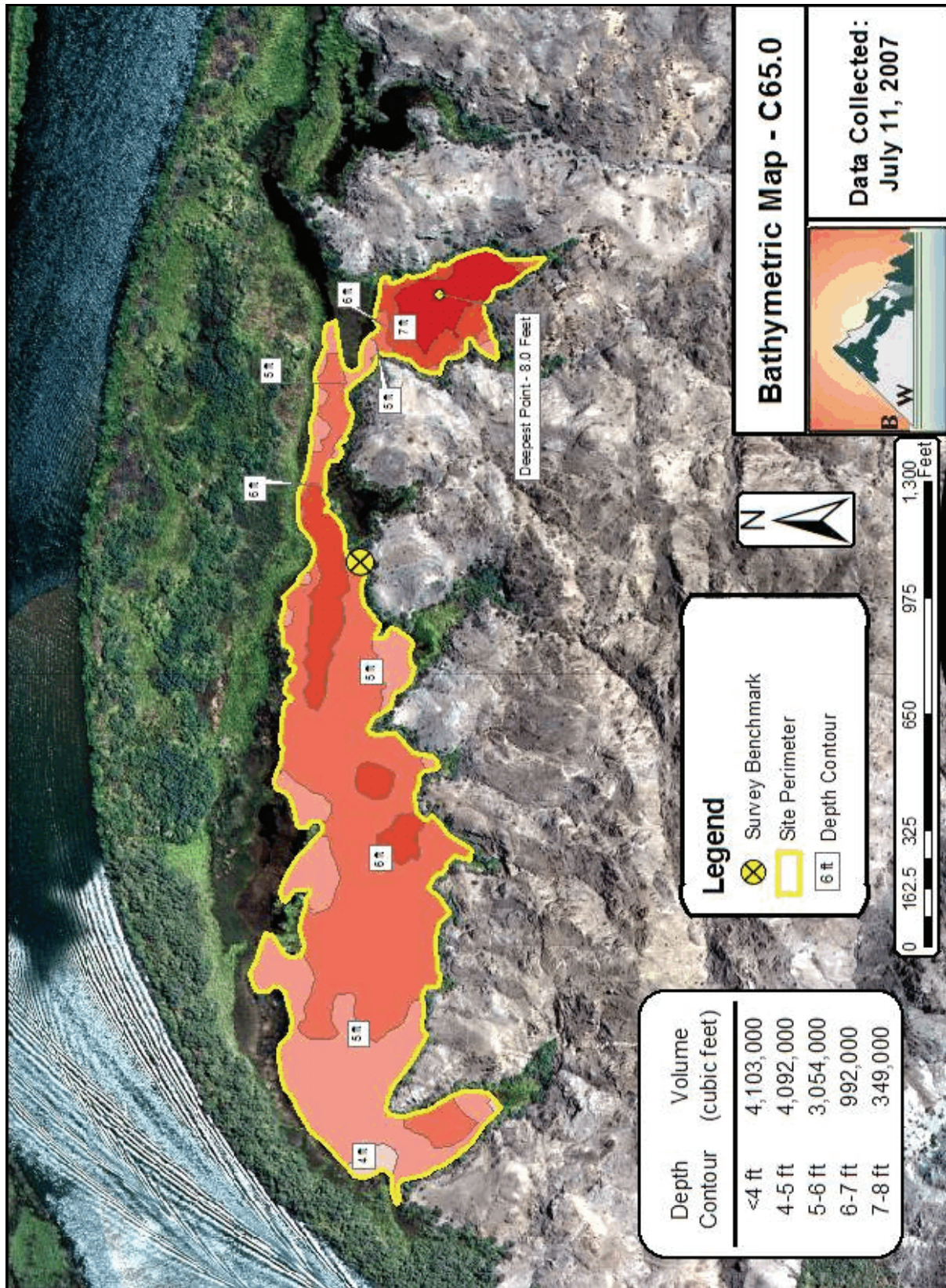
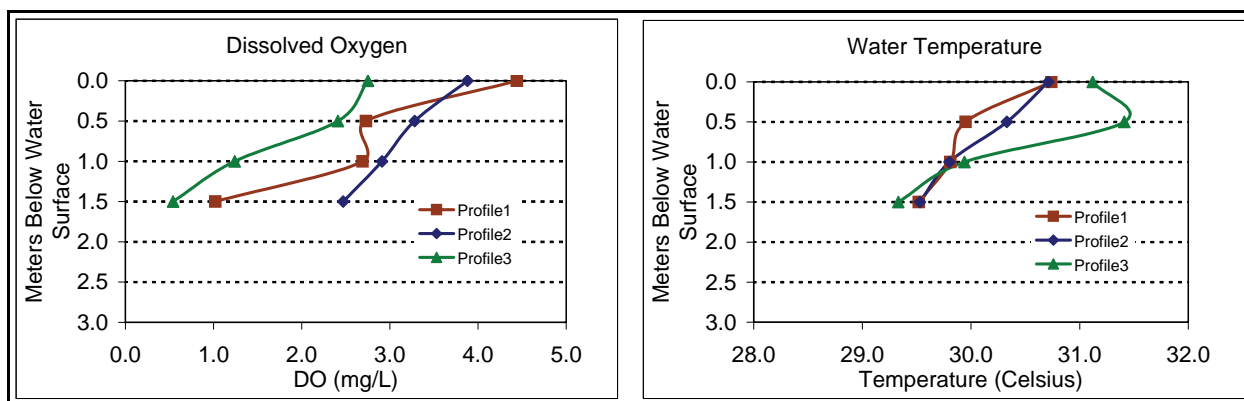


Figure 14. Bathymetric map of site C65.0.

## A64.5 (Lookout Lake) - High Rating

Site A64.5 is 4.3 acres and was directly connected to the Colorado River during field data collection. Many standing tree trunks were observed. With an SDI value of 1.24, this site has one of the lowest shoreline complexity values among all sites evaluated during this effort.

The total biological suitability criteria score for this site was 56, which gives it a high habitat creation opportunity rating. Despite the high rating overall, this site had two substantial water quality problems. Average DO concentrations at both 1 m above the substrate and 1 m below the water surface were below 3.0 mg/L (24-h water quality data had a DO concentration range of 0.10–1.5 mg/L) and there was more than 50% relative abundance of cyanobacteria in the algae sample. Water temperature was 29.9°C with a 24-h range of 28.8–31.2°C. This site ranked among the highest in cover because of the presence of boulders and because turbidity was in the high suitability category (one of only four sites). Mean water depth was 5.3 ft; only 33.8% was more shallow than 5 ft and no area was deeper than 10 ft. The profile data revealed no distinct stratification (Figure 15).



**Figure 15. Water quality profile data for site A64.5.**

Figure 16 provides an overview map of site A64.5. This site has a critical flaw in low DO concentration that would have to be evaluated and potential solutions tested prior to successful habitat creation at this site. There is also a potential problem with high cyanobacteria, which is indicative of an advanced successional state. The positive aspects of the site include excellent cover characteristics as well as sufficient spawning habitat availability.



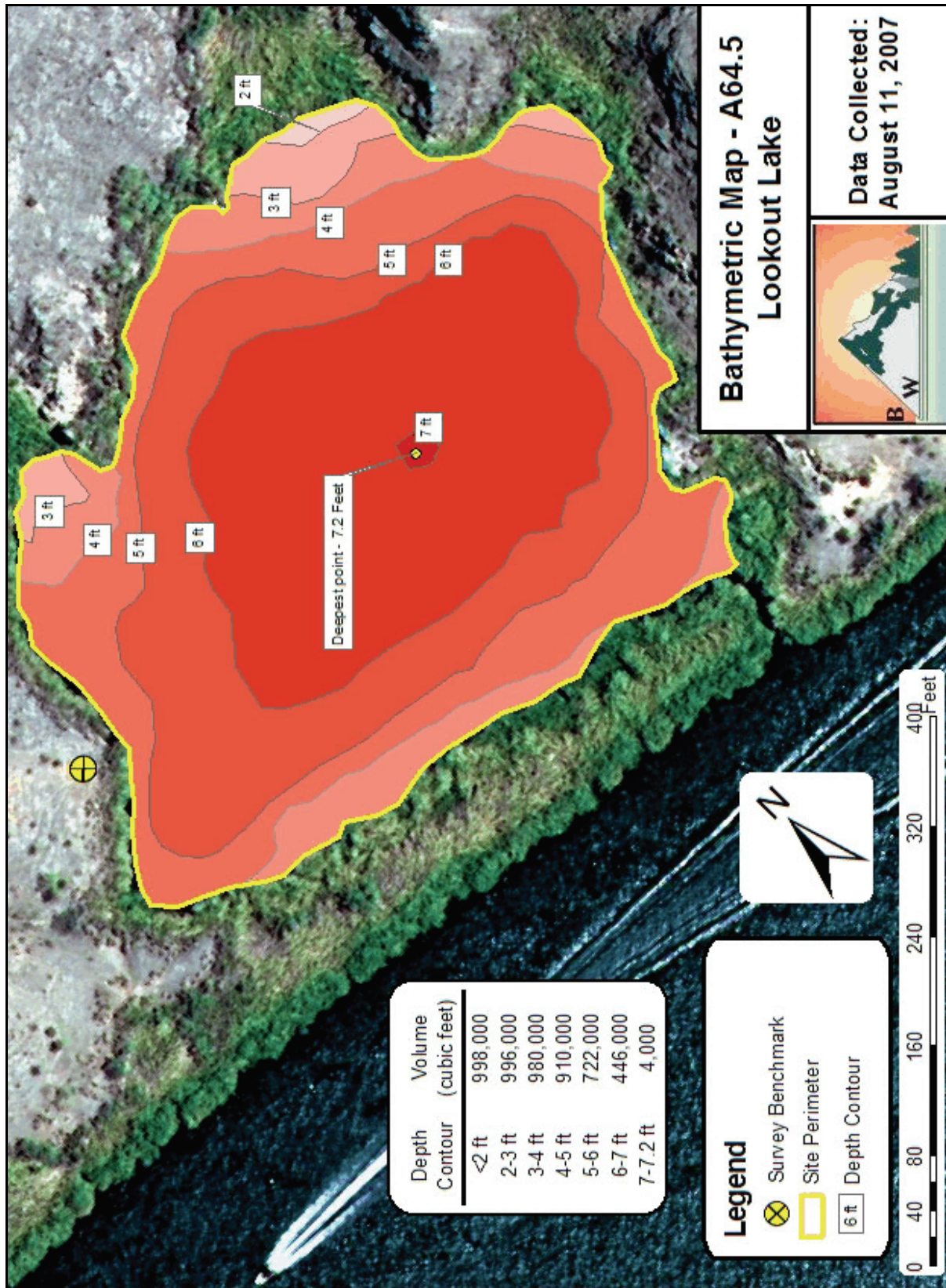
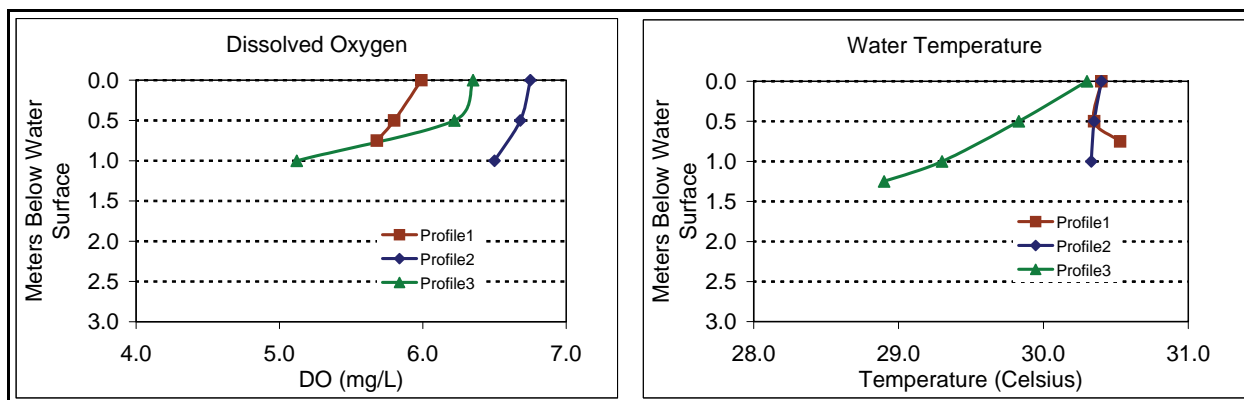


Figure 16. Bathymetric map of site A64.5.

## C64.4 - High Rating

Site C64.4 was originally delineated at 8.4 acres, but after collecting bathymetric data, the adjusted site dimensions resulted in an area of 7.8 acres. The site appeared to be isolated from the river during field data collection, but water quality data suggests that some surface connection may exist. The SDI value of 2.31 indicates a moderate shoreline complexity.

The total biological suitability criteria score for this site was 59, which gives it a high habitat creation opportunity rating. Water quality was very good with an average DO value of 6.23 mg/L, specific conductivity of 1364  $\mu\text{S}/\text{cm}$  and a chlorophyll *a* concentration of less than 2.0 mg/L. Average water temperature was not ideal at 30.2°C, which is likely a result of the shallow nature of this site (mean depth was 4.2 ft). Water quality data collected over 24 hours had a range of DO concentration from 3.8 to over 6.9 mg/L and a water temperature range from 30.1–32.0°C. This site had high suitability in both categories of spawning habitat, but poor cover (too little vegetation, no boulders or deep areas, and few standing tree trunks). There appeared to be some temperature stratification in one of the three profiles at this site (the deepest one), but the other two had constant values through the water column (Figure 17).



**Figure 17. Water quality profile data for site C64.4.**

Figure 18 provides an overview map of site C64.4. Although the average DO concentration was in the high suitability category, the 24-h data included values below 4.0 mg/L. This is still well within the moderate suitability range, but spatial and seasonal variation may cause some areas of the site to fall into the low suitability range at certain times. The only other potential problem in this site is limited cover. The amount of submergent vegetation was well below the 10% threshold and no boulder substrate was observed. This site may require manual placement of cover features in the habitat creation process. As with other sites, there would be a benefit to dredging deeper areas into the site.



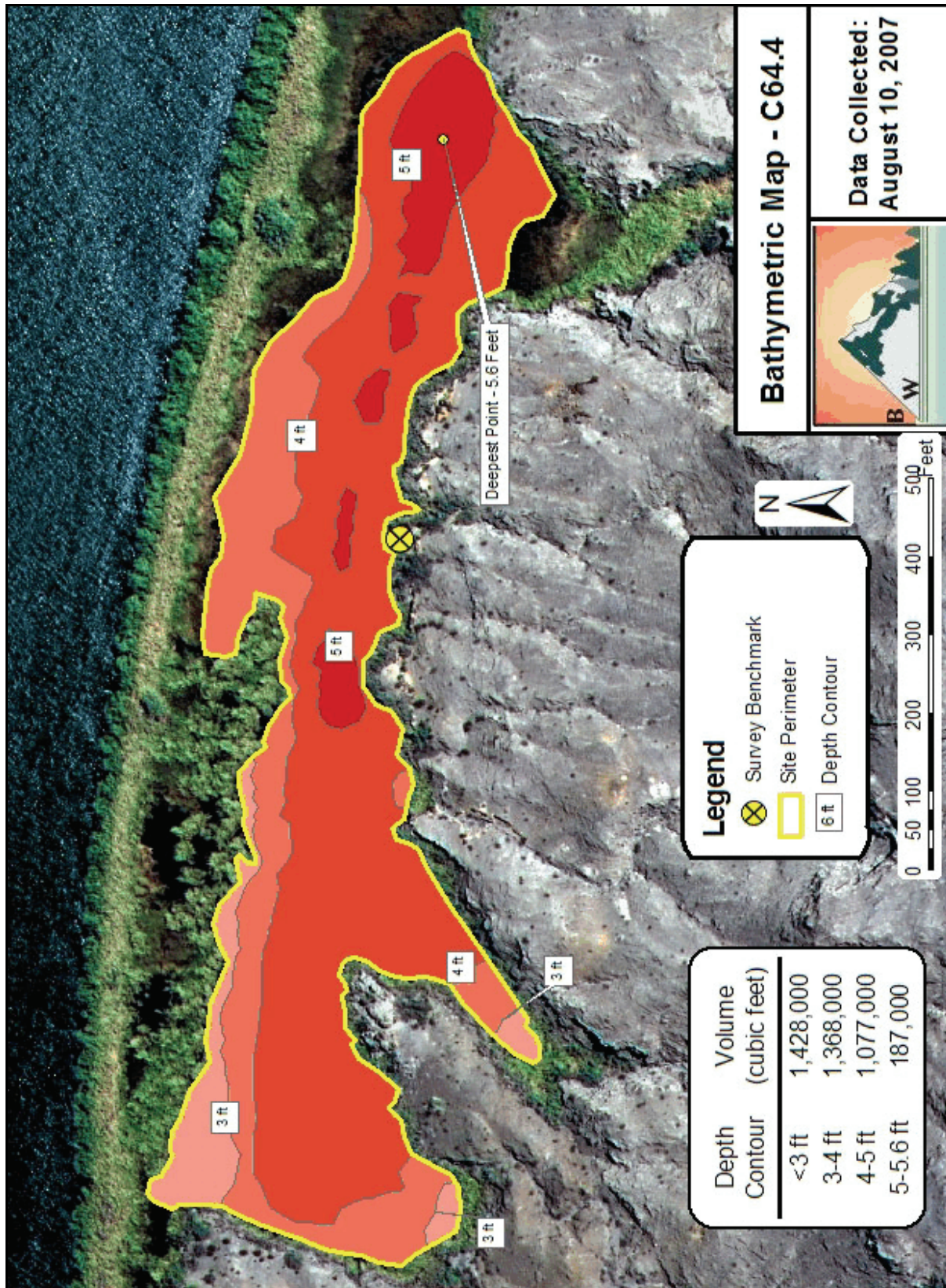
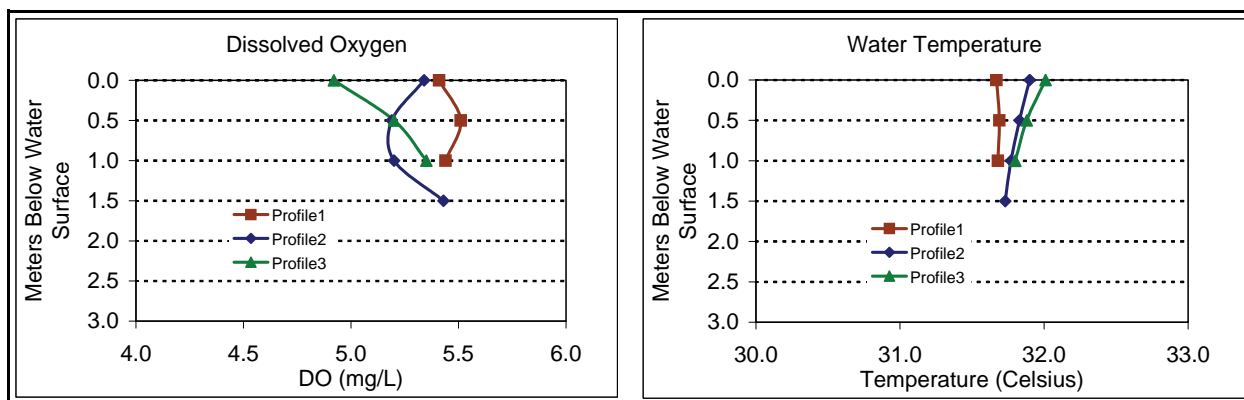


Figure 18. Bathymetric map of site C64.4.

## C64.1 - High Rating

Site C64.1 is 3.8 acres and was one of the two evaluated that were originally listed as alternates. This site was selected to replace A68.5 due to difficulty of access. The site appeared to be isolated from the river during field data collection, but water quality data suggests that some surface connection may exist. The SDI value of 1.49 indicates a relatively low shoreline complexity.

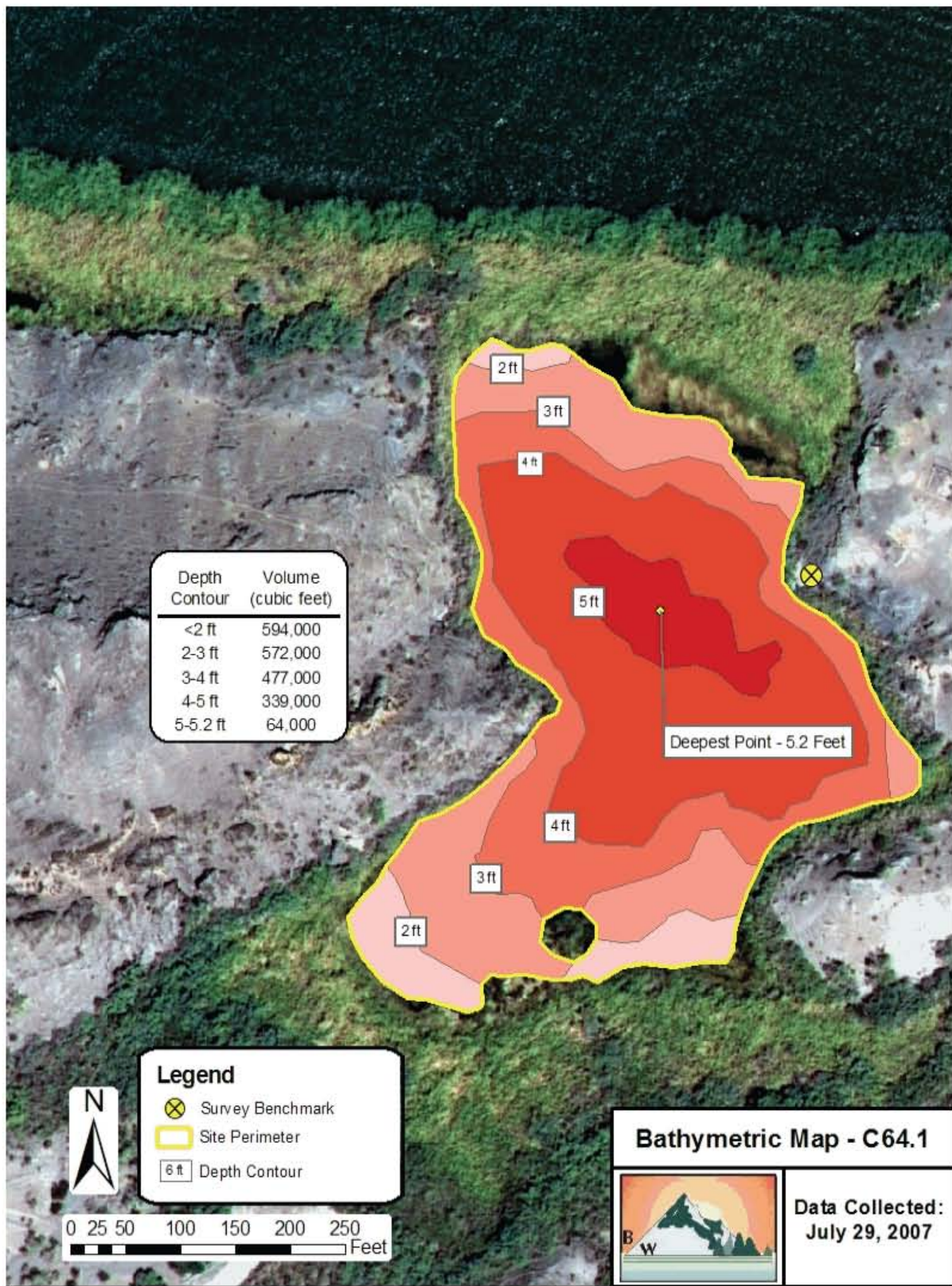
The total biological suitability criteria score for this site was 53, which gives it a high habitat creation opportunity rating. Water quality was very good with an average DO value of 5.3 mg/L (24-h range of 4.5–7.3 mg/L), specific conductivity of 1477  $\mu\text{S}/\text{cm}$  and no cyanobacteria observed in the algae sample. Water temperature was high, averaging 31.8°C (24-h range of 31.2–33.6°C), which is largely a result of the shallow conditions (mean depth was 3.6 ft). The high temperature resulted in a low suitability score for that category. The majority (92.4%) of this site was less than 5 ft deep and no area was greater than 10 ft, which also caused it to score low in the two depth categories. In addition to being shallow and hot, there was limited cover available to fish (no submergent vegetation or boulders and no deep refuge). There was no distinct temperature or DO stratification observed in this site from the profile data (Figure 19).



**Figure 19. Water quality profile data for site C64.1.**

Figure 20 provides an overview map of site C64.1. Despite the high rating for this site, there are some concerns about its prospect to support native fish. The site is very shallow, has no vegetation and high temperatures. However, it does have good DO concentrations despite the lack of vegetation and that is probably one of the most difficult areas to correct. If habitat creation efforts included dredging and addition of cover, this could be a good prospect.



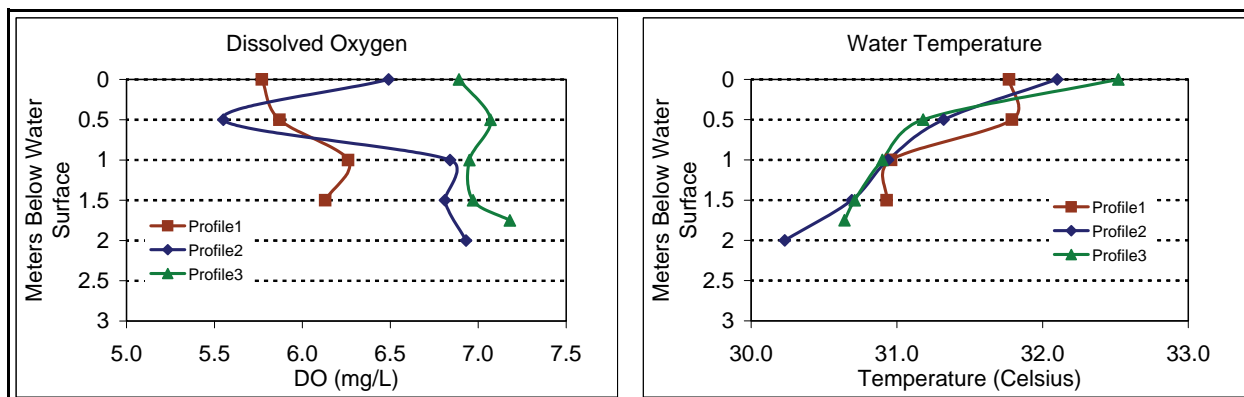


**Figure 20. Bathymetric map of site C64.1.**

## C63.8 - Excellent Rating

Site C63.8 is 4.8 acres and appeared to be isolated from the river during field data collection, but water quality data suggests that some surface connection may exist. The SDI value of 1.85 indicates a relatively low shoreline complexity.

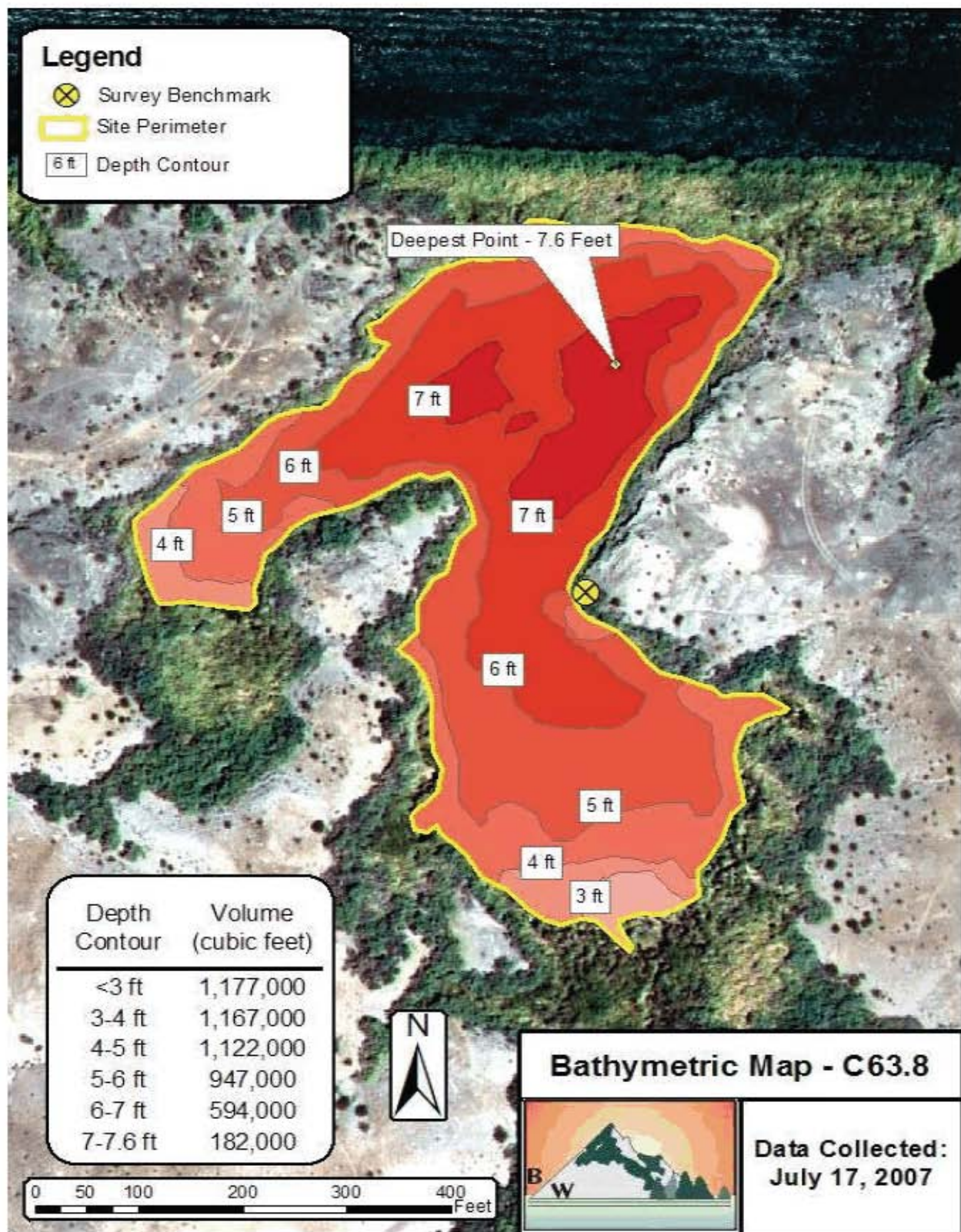
The total biological suitability criteria score for this site was 63, which gives it an excellent habitat creation opportunity rating. Water quality was very good with an average DO value of 6.68 mg/L (24-h range of 4.1–7.1 mg/L), specific conductivity of 1200  $\mu\text{S}/\text{cm}$  and it had high suitability for both chlorophyll *a* concentration and cyanobacteria counts. Water temperature was not ideal, averaging 30.2°C (24-h range of 29.3–32.7°C) to give the site a moderate score for this category. The site had a mean depth of 5.7 ft, and only 27% was more shallow than 5 ft, but it did not have a deep water refuge (greater than 10 ft). The site did have some boulder-sized substrates that would serve as beneficial cover features for native fish, as well as numerous standing tree trunks, but there was very little submergent vegetation. The profile data suggested that some thermal stratification occurs over the 2 m of water depth, but little vertical variation in oxygen concentration was observed (Figure 21).



**Figure 21. Water quality profile data for site C63.8.**

Figure 22 provides an overview map of site C63.8. This site appears to be a very good prospect for habitat creation. The site appeared less desirable because many small algae “mats” broke free from the substrate and floated to the surface during the hours of greatest photosynthesis (forming numerous bubbles that lift the algae from the bottom). However, the 24-h water quality data does not show excessive variation in DO concentration, which is often associated with sites having abundant algae. Water temperature was higher than many other sites, and the lack of vegetation limits cover, but all data suggest that this is an excellent prospect for native fish habitat. The thermal variation in this site may restrict fish to using deep areas for refuge and may concentrate fish. The DO concentration did not appear to be limiting, but this should be thoroughly evaluated in the deeper parts of the site if fish would be restricted there.



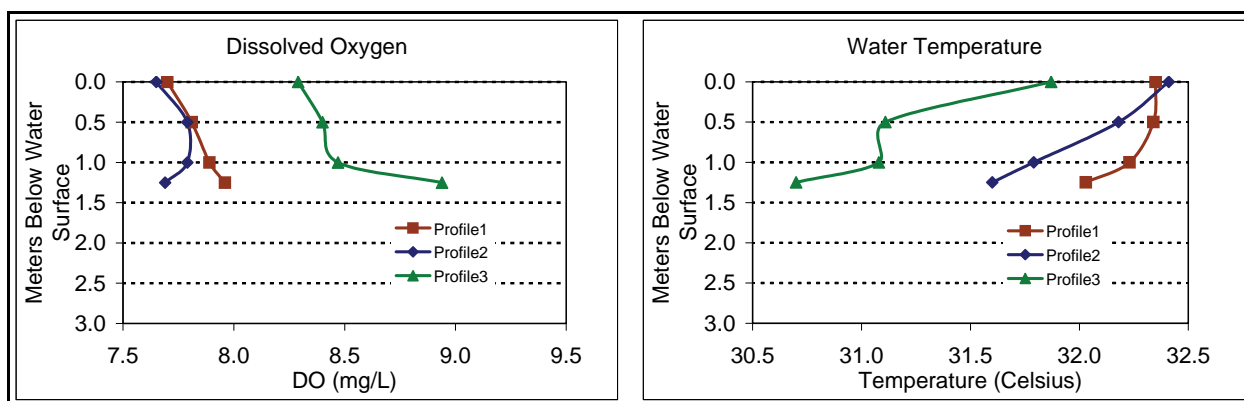


**Figure 22. Bathymetric map of site C63.8.**

## A63.7 (Cable Lake) - High Rating

Site A63.7 is 17.4 acres and was connected to the river during field data collection. The SDI value of 2.16 indicates a moderate shoreline complexity.

The total biological suitability criteria score for this site was 59, which gives it a high habitat creation opportunity rating. Water quality was good with an average DO value of 8.00 mg/L (24-h range of 6.1–8.1 mg/L), specific conductivity of 1368  $\mu\text{S}/\text{cm}$ , and no cyanobacteria observed in the algae sample. Water temperature averaged 31.9°C (24-h range of 30.8–32.3°C). This value resulted in a low suitability score for that category. Mean depth of the site was 5.5 ft and only 30.2% was more shallow than 5 ft (high suitability score) but no area was greater than 10 ft (low suitability score). This was one of the few sites that had turbidity in the high suitability range (barely at 10.3 NTU), but all other components of cover were lacking. There was some difference in temperature with depth observed in the profile data, but no distinct stratification in this site (Figure 23).



**Figure 23. Water quality profile data for site A63.7.**

Figure 24 provides an overview map of site A63.7. This site had high water temperature and a distinct lack of vegetation or standing tree trunks for cover; however, this site was deeper than some of the other sites. The high DO concentrations (despite the lack of vegetation) is a positive benefit because it is one of the most difficult areas to correct. However, these conditions are likely to change if there is a modification of its connectivity to the river.



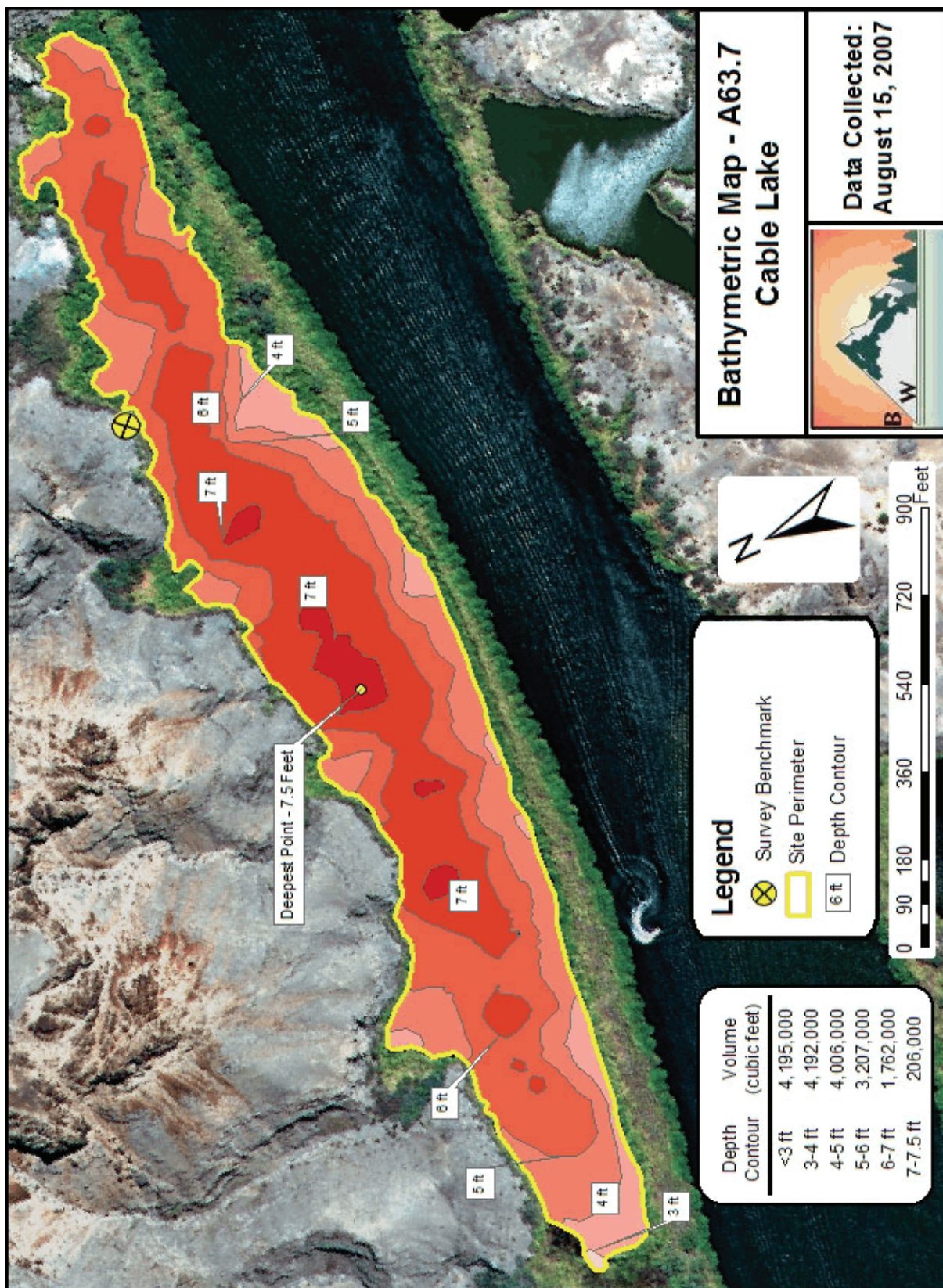
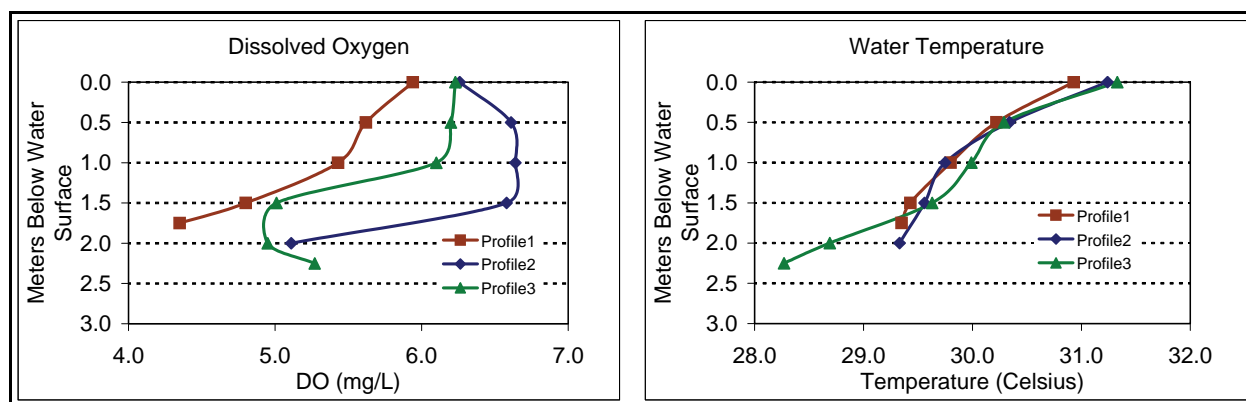


Figure 24. Bathymetric map of site A63.7.

## C62.9 (Duck Lake) - High Rating

Site C62.9 was originally delineated at 36.1 acres, but after collecting bathymetric data, the adjusted site dimensions resulted in an area of 35.2 acres. The site appeared to be isolated from the river during field data collection, but water quality data suggests that some surface connection may exist. The SDI value of 2.95 indicates a relatively high shoreline complexity.

The total biological suitability criteria score for this site was 59, which gives it a high habitat creation opportunity rating. Water quality was good with an average DO value of 6.1 mg/L (24-h range of 6.6–8.4 mg/L) and specific conductivity of 1419  $\mu\text{S}/\text{cm}$ , but temperature was in the moderate suitability range (29.7°C and range of 29.1–31.9°C over 24 hours). This site also had higher frequency of cyanobacteria (41%) than many other sites, which could become more of a problem if the current hydraulic interaction with the river is modified; however, it currently measured in the high suitability category. Both spawning habitat criteria had high scores, but cover was poor with too much vegetation, no boulders and no deep water refuge. However, there were numerous standing tree trunks observed on site. There was a fairly large change in temperature (approximately 3.0°C) observed in just over 2 vertical meters in the profile data (Figure 25). This trend was also apparent in DO concentration.



**Figure 25. Water quality profile data for site C62.9.**

Figure 26 provides an overview map of site C62.9. The abundance of submergent vegetation may lead to large seasonal DO concentration fluctuations. However, during this sampling period, there was high DO concentration and generally good water quality overall (chlorophyll *a* and cyanobacteria counts may be a concern if there is a change in the current hydraulic interaction with the river). This site was also much deeper than many others with a mean depth of 7.1 ft.



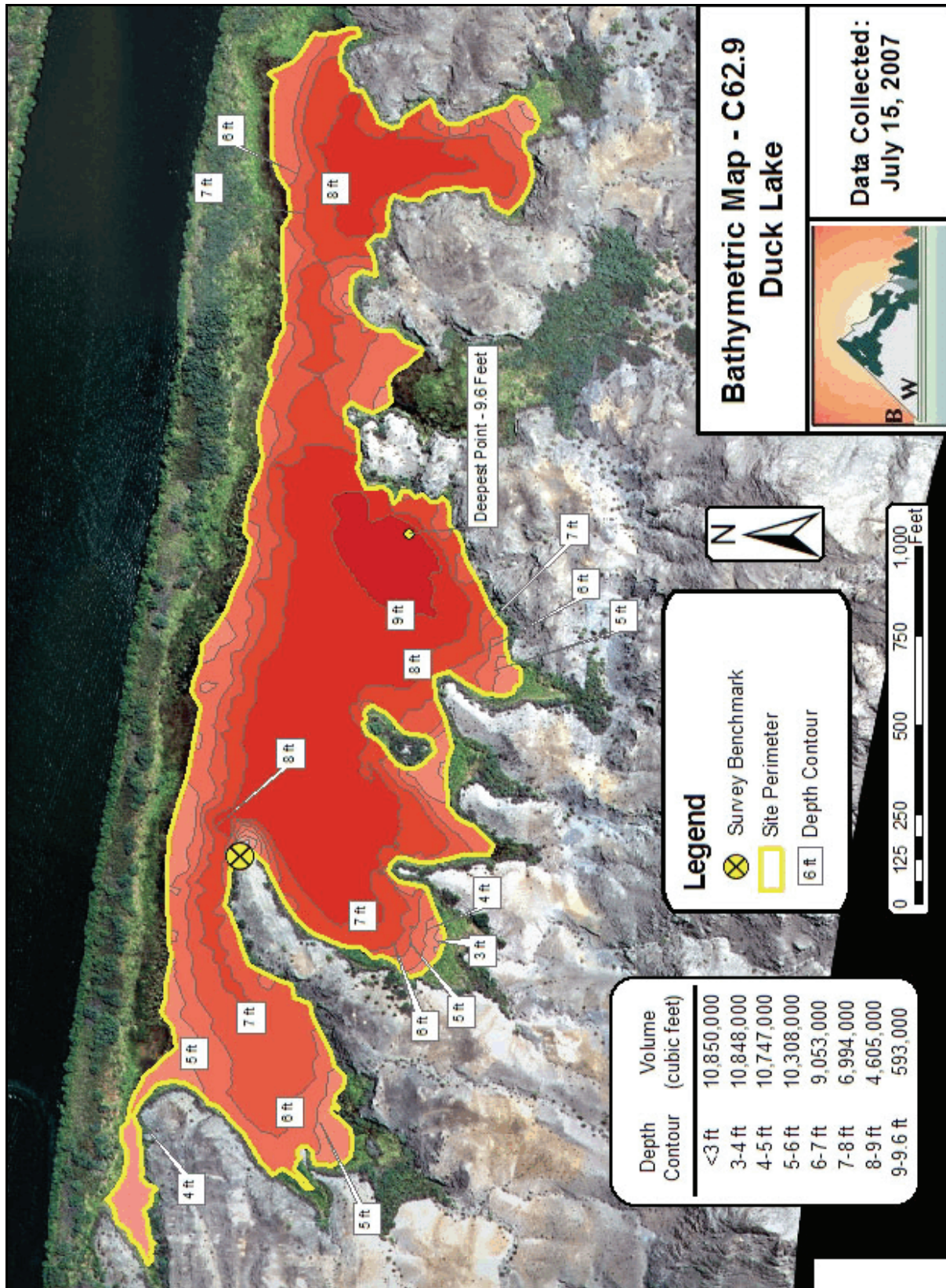
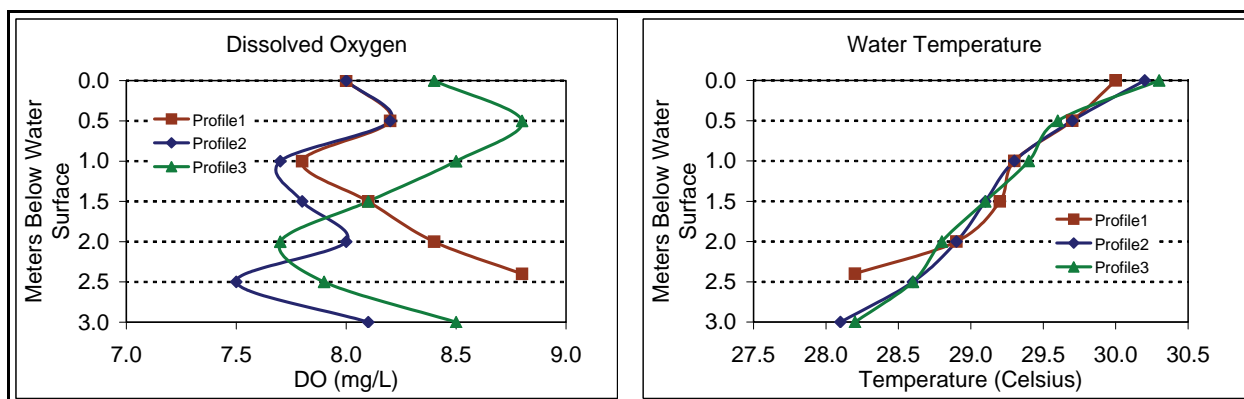


Figure 26. Bathymetric map of site C62.9.

## A62.3 (Secret Lake) - Excellent Rating

Site A62.3 is 11.2 acres and was directly connected to the river during field data collection. The SDI value of 1.64 indicates a relatively low shoreline complexity.

The total biological habitat suitability score for this site was 71, the highest of all sites evaluated during this field study. Water quality was very good with an average DO value of 8.0 mg/L (24-h range of 8.1–8.7 mg/L), specific conductivity of 1344  $\mu\text{S}/\text{cm}$ , and few cyanobacteria observed in the algae sample. Water temperature was in the moderate range at 29.0°C (24-h range of 28.7–30.6°C), and chlorophyll was higher than many other sites (6.8  $\mu\text{g}/\text{L}$ ) but still scored high in suitability. This site was deeper on average than any other evaluated (mean depth of 8.2 ft) and was one of only two sites with a deep water refuge (26.2% of the area was greater than 10 ft deep). This site did not appear to have as many standing tree trunks as other sites but several completely submerged trees were encountered during substrate sampling. There was a moderate change in temperature (approximately 2.5°C) observed in 3 vertical meters in the profile data (Figure 27). There appeared to be no trend in the DO concentration data from these profiles.



**Figure 27. Water quality profile data for site A62.3.**

Figure 28 provides an overview map of site A62.3. This site appears to have justifiably scored highest among all sites. With slightly lower temperature and turbidity values, this site would have scored a perfect 75. The water depth undoubtedly contributes to much of the excellent habitat conditions as does the generally steep banks, which prevent excessive emergent vegetation and contribute organic material to the sediments. While not reported as part of the site scoring, the abundance and diversity of fish captured in this site suggest excellent fish habitat overall.



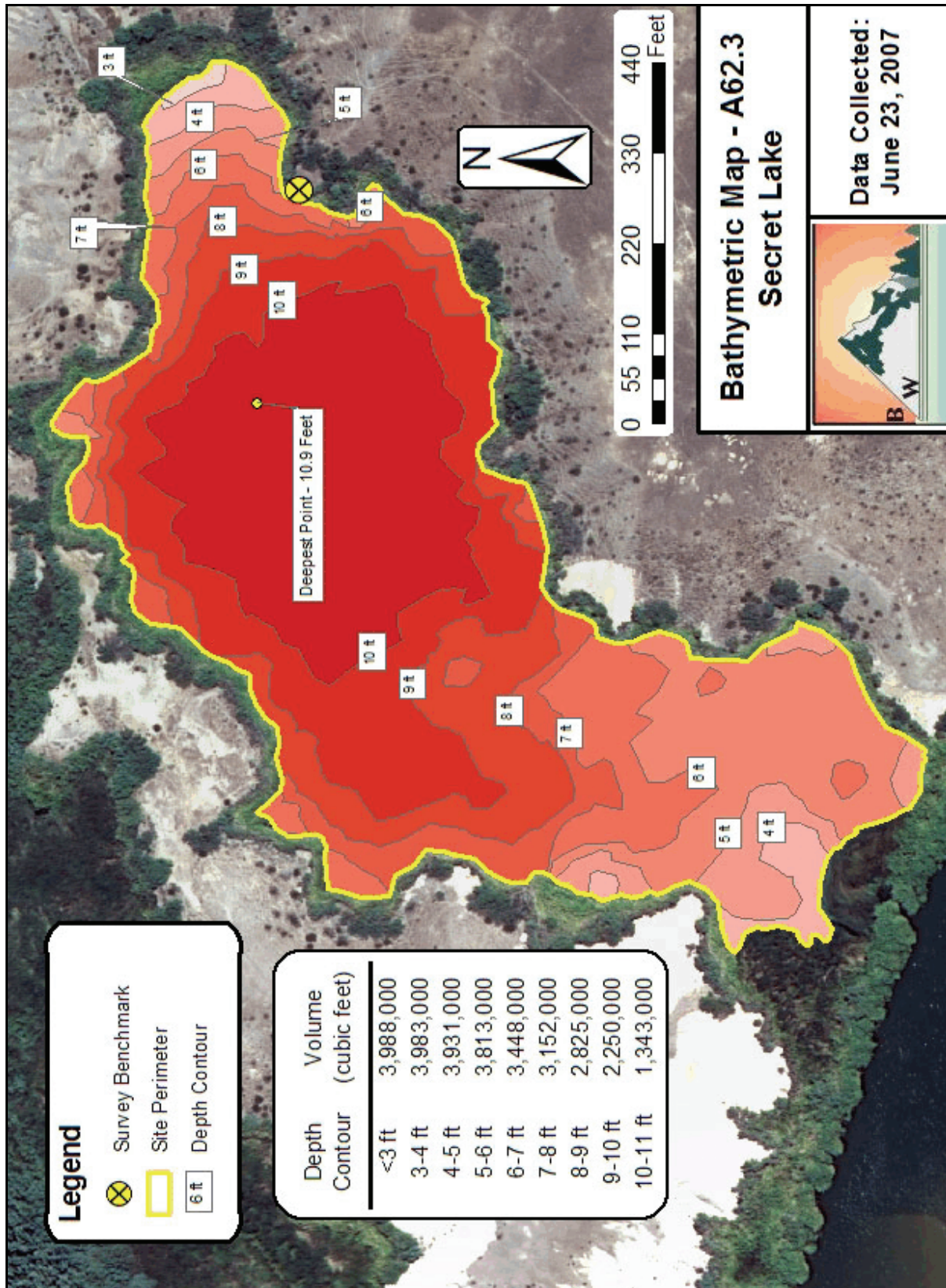


Figure 28. Bathymetric map of site A62.3.

## A59.7 (Headquarters Lake) - High Rating

Site A59.7 was originally delineated at 12.0 acres (including pools A and B), but after collecting bathymetric data, the adjusted site dimensions resulted in an area of 18.2 acres. The site was directly connected to the river during field data collection. The shoreline complexity (SDI value of 5.23) was much higher in this site than any other; it is essentially a narrow channel (i.e., it deviates greatly from a circle).

The total biological suitability criteria score for this site was 55, which gives it a high habitat creation opportunity rating. Water quality scored very well (both pools combined) with an average DO value of 7.3 mg/L, specific conductivity of 1350  $\mu\text{S}/\text{cm}$ , and few cyanobacteria observed in the algae sample. Despite the high DO concentration, the 24-h water quality data (collected approximately 1 m below the surface in the southeast end of Pool B) ranged from 0.1–6.2 mg/L and suggest that there may be critically low values each day. Water temperature was also high, averaging 30.4°C (24-h range of 31.2–30.6°C), with the highest values recorded in the relatively shallow southeast end of Pool B. Compared to other sites, this site had the highest phosphorus concentration in its water quality water sample, but at 16.0 mg/L, it is still far below target levels identified by the State of Arizona in its nutrient targets (AZDEQ 2007). The mean depth of 6.3 was deeper than many sites, but there were just a few relatively deep areas (none greater than 10 ft) with the majority (61.7%) more shallow than 5 ft. There was not enough gravel to qualify for the higher score in that category. There was an abundance of vegetative cover, but no boulders observed and turbidity just a little too low to earn the higher score. No distinct DO or temperature stratification was observed in this site from the profile data (Figures 29 and 30).

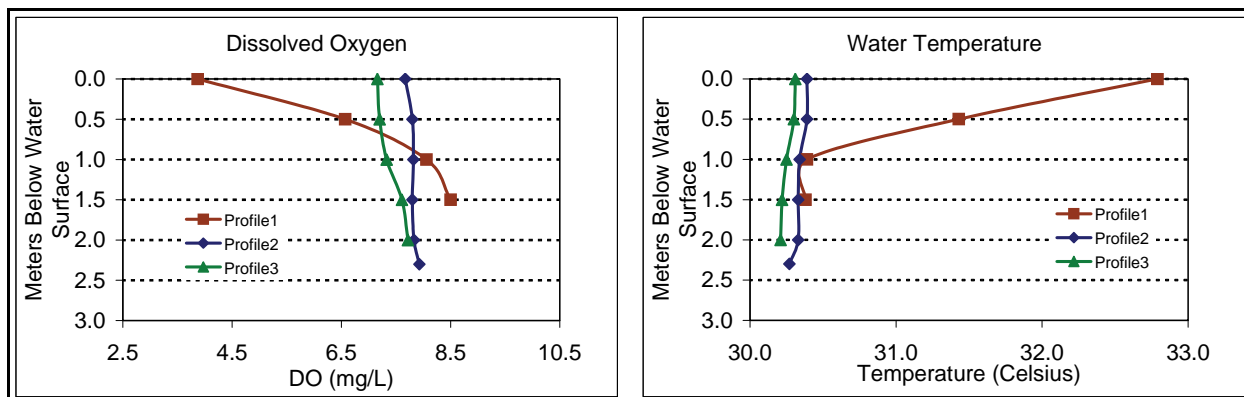
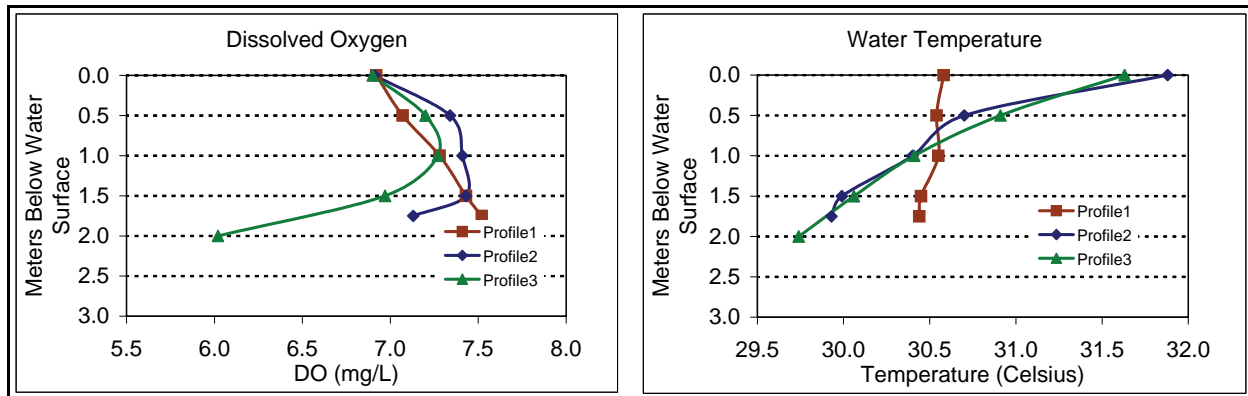


Figure 29. Water quality profile data for site A59.7 Pool A.



**Figure 30. Water quality profile data for site A59.7 Pool B.**

Figures 31 and 32 provide an overview map of site A59.7. Although this site scored high for DO concentration, the 24-h water quality data introduces some serious concern about very low values occurring during the night (DO was below 1.0 mg/L for 11 consecutive hours between 4:00 p.m. and 2:00 a.m.). The 24-h water quality data was collected in the southeast end of Pool B, which was shallow (nearly all less than 5 ft deep) and had primarily silty substrates. Dissolved oxygen should be monitored more carefully before selecting this site, particularly in this portion of Pool B. There appears to be spatial variability in water quality conditions throughout this site and a more thorough evaluation of water quality there may include setting datasondes for 24 hours in multiple locations to capture this variability in the data set. The abundance of shallow habitat and high temperatures are other issues that would need to be evaluated for corrective action to create suitable native fish habitat in this site.



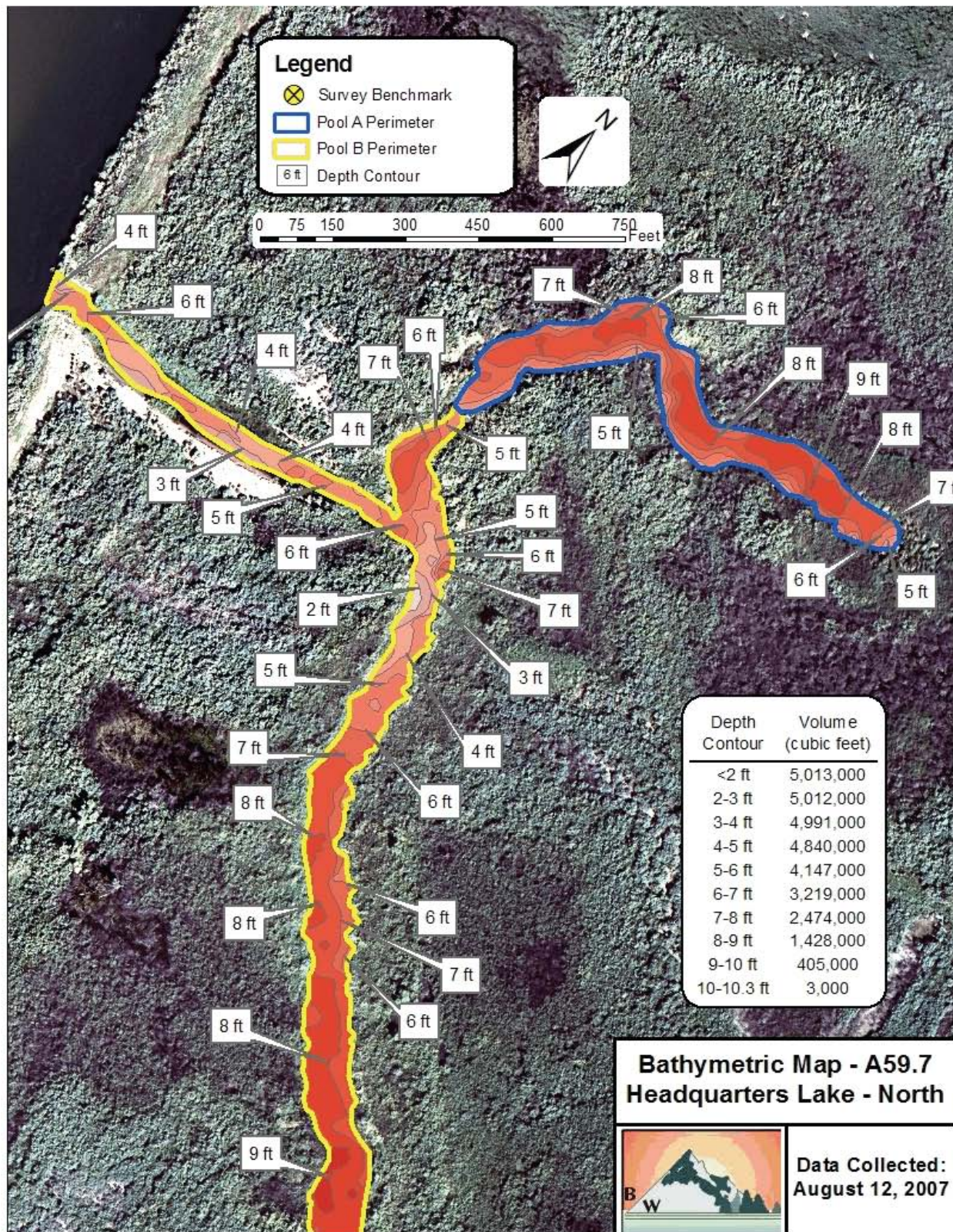


Figure 31. Bathymetric map of site A59.7 - North.



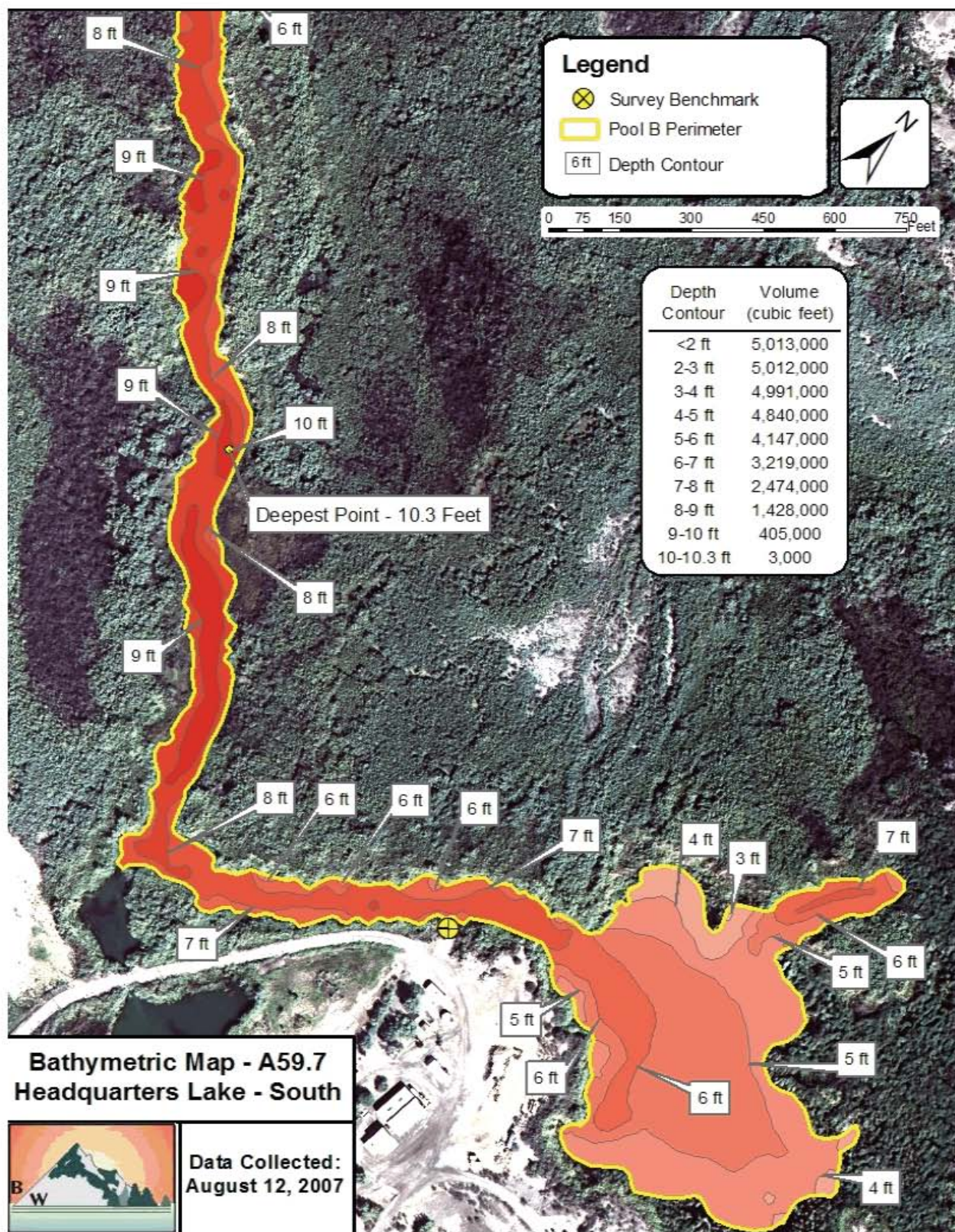
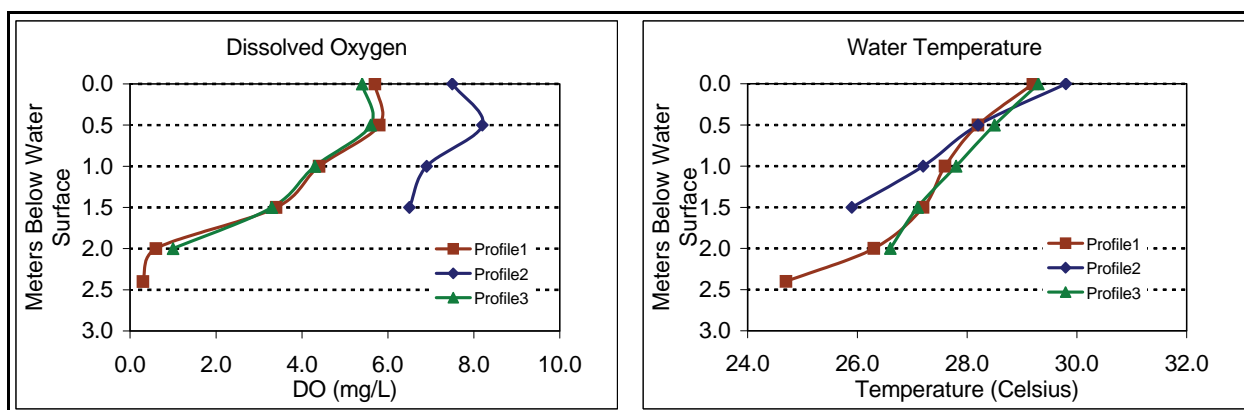


Figure 32. Bathymetric map of site A59.7 - South.

## C57.6a (Northern Ferguson Lake) - High Rating

Site C57.6a was originally delineated at 22.1 acres, but after collecting bathymetric data, the adjusted site dimensions resulted in an area of 28.5 acres. The site was directly connected to the river during field data collection. The SDI value of 3.87 was among the highest of all sites and indicates high shoreline complexity.

The total biological suitability criteria score for this site was 55, which gives it a high habitat creation opportunity rating. Water quality was very good with an average DO value of 5.2 mg/L (24-h range of 3.6–5.7 mg/L), specific conductivity of 1960  $\mu\text{S}/\text{cm}$ , and an average water temperature that was just above the high suitability range (27.4°C, with a 24-h range of 27.5–29.2°C). This site was shallow, averaging 3.8 deep; 81.5% of the site is more shallow than 5 ft. There were poor cover characteristics with too much vegetation, no small boulders, relatively high turbidity, and no depth refuge. A relatively large change in water temperature was observed in the profile data (Figure 33) with a change of 4–5°C over 2.0–2.5 vertical meters. Dissolved oxygen dropped to nearly zero near the bottom in two of the three profiles.



**Figure 33. Water quality profile data for site C57.6a.**

Figure 34 provides an overview map of site C57.6a. The DO concentration at this site rated in the high suitability range, but the profiles show that there is a sharp decline near the substrate and the 24-h data suggests values drop to relatively low levels every day. In addition, organic matter has apparently accumulated and led to a high total organic carbon value in the water sample (9.4 mg/L). These observations are likely influenced by connectivity to the river. Although it has a direct connection, this site is approximately 3 km upstream from the outlet to the river, which presumably limits the hydraulic interaction. The water in this site likely has a high residence time and does not readily move to or from the river. The conditions observed at this site may provide some insight as to the types of changes that would begin to occur in water quality in sites that are hydraulically disconnected from the river. Isolated sites would be expected to have these types of conditions without intervention. The greatest limitation to this



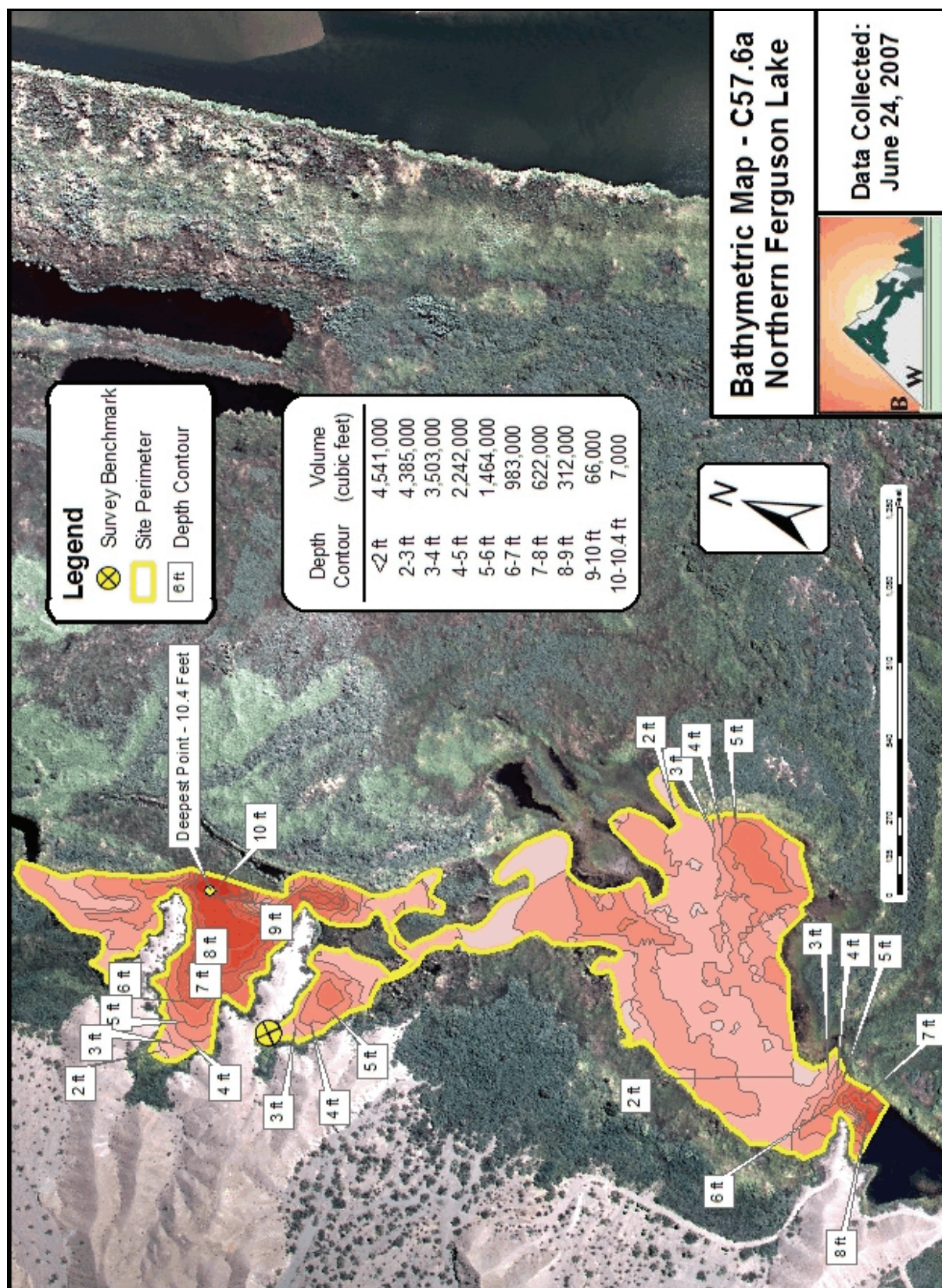


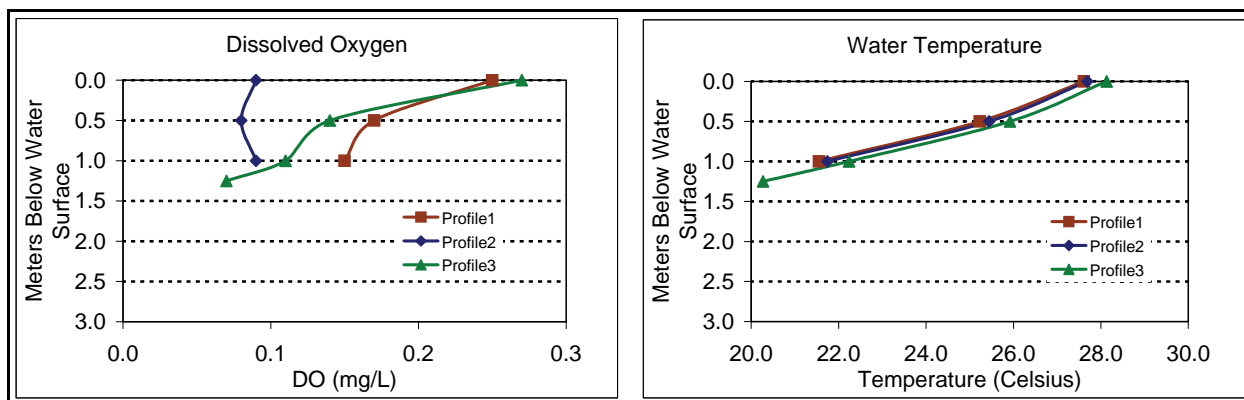
Figure 34. Bathymetric map of site C57.6a.

site may be the shallow depth. More shallow sites generally have multiple habitat limitations that would be exacerbated if isolated from the river. Dredging would likely be necessary in this site to create suitable habitat for native fishes.

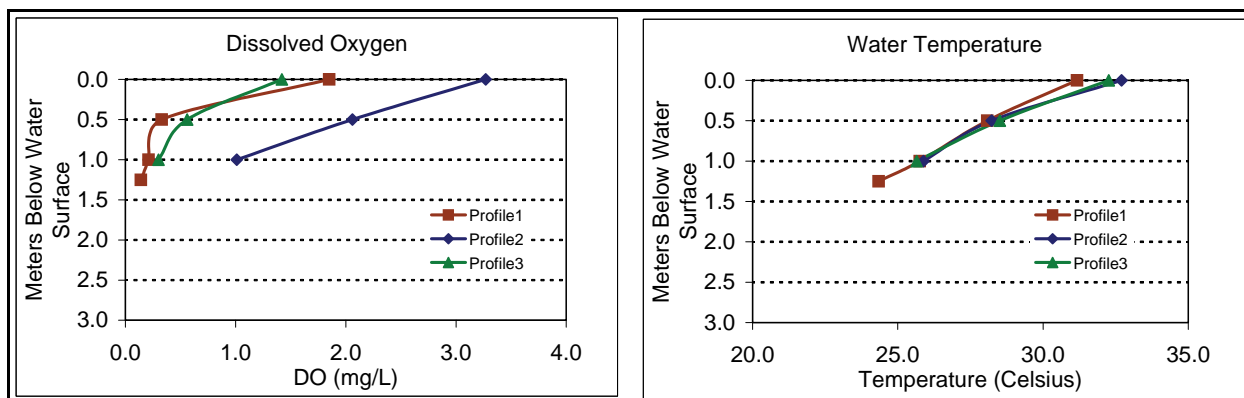
## C57.6 - Low Rating

Site C57.6 was originally delineated at 22.1 acres, but after collecting bathymetric data, the adjusted site dimensions resulted in an area of 28.5 acres. This site was clearly isolated from the river and water quality data were substantially different than other sites. The SDI value of 4.37 indicates very high shoreline complexity.

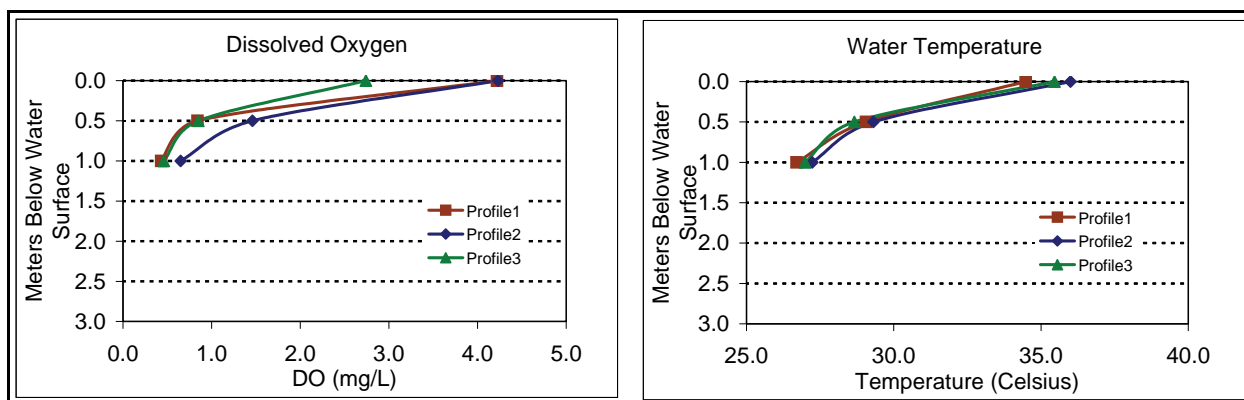
The total biological suitability criteria score for this site was 36, the lowest of all sites, which gives it a low habitat creation opportunity rating. Water quality was poor with an average DO value of 0.72 mg/L (24-h range of 0.03– 0.25 mg/L), specific conductivity of 3550  $\mu\text{S}/\text{cm}$ , and very high values for both chlorophyll *a* and cyanobacteria counts. Average water temperature was a little high at 27.6°C (24-h range of 27.7–28.8°C) but much lower than expected for a completely isolated spot. Field crews noted the presence of springs introducing cold water in several locations. The water sample also revealed problems in the site. Total organic carbon values were very high in each of the 3 pools (17.0–26.0 mg/L), indicating a buildup of detritus and conditions that promote rapid ecological succession. This site also had some of the highest concentrations of several water quality parameters, including boron, magnesium, manganese, potassium, silica, and sodium. No gravel was observed in the site and 79.7% of the area evaluated for depth was less than 5 ft deep. Cover was poor with no vegetation, boulders, or deep water refuge area. There was nearly a 10°C change in temperature over less than 1.5 vertical meters observed in the profile data (Figures 35, 36, and 37), which is consistent with observations of cold spring inputs.



**Figure 35. Water quality profile data for site C57.6 Pool A.**



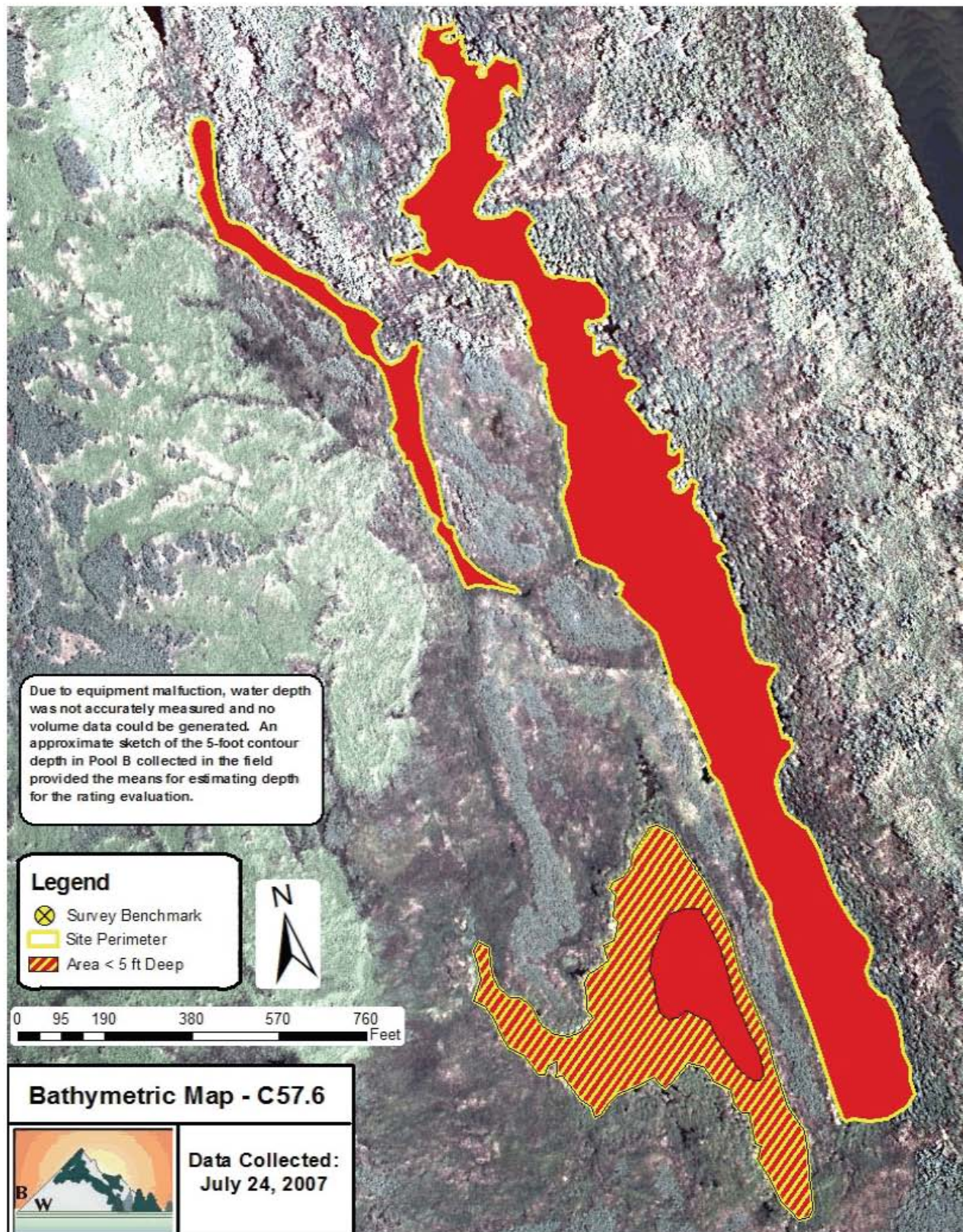
**Figure 36. Water quality profile data for site C57.6 pool B.**



**Figure 37. Water quality profile data for site C57.6 Pool C.**

Figure 38 provides an overview map of site C57.6. This site has great habitat limitations and water issuing from the springs. The most compelling limitation for this site is the extremely low DO concentration throughout the water column. Surprisingly, a common carp was captured in the site, but these low DO conditions are usually only tolerated by *Gambusia* sp. and bullhead. This site would require establishment of some sort of surface connection with the river (with a filter to prevent non-native species intrusion) in order to dramatically improve conditions. The site would also need gravel, cover, and potentially a dredging effort to remove the deep silt and increase overall depth of the site.



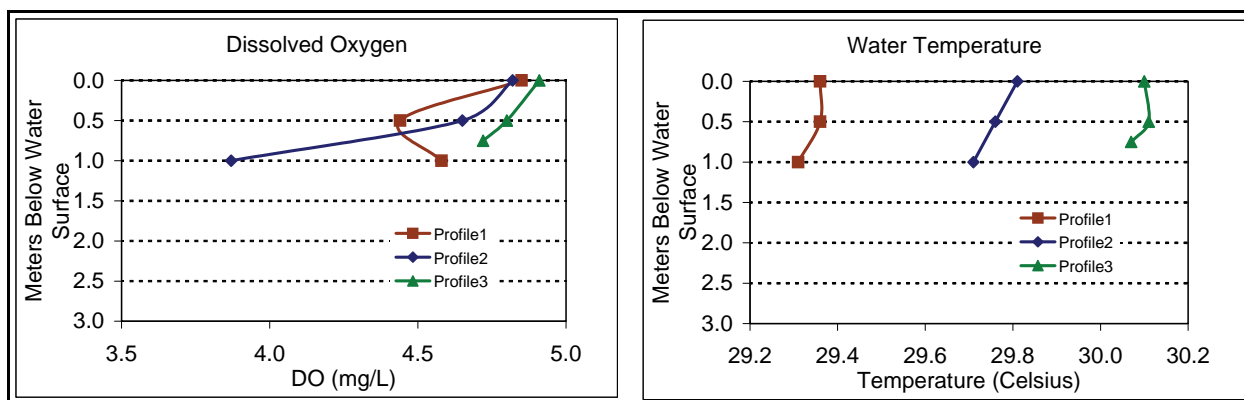


**Figure 38. Bathymetric map of site C57.6.**

## A55.4 - Moderate Rating

Site A55.4 is 14.5 acres with no visible surface connection to the river. The SDI value of 2.16 indicates a moderate shoreline complexity.

The total biological suitability criteria score for this site was 48, which gives it a moderate habitat creation opportunity rating. Water quality is fair with an average DO value of 4.6 mg/L (24-h range of 1.0–5.8 mg/L), specific conductivity of 1425  $\mu\text{S}/\text{cm}$ , and no cyanobacteria observed in the algae sample. Average water temperature was in the moderate suitability range, at 29.7°C (24-h range of 29.0–30.7°C), which is largely a result of the shallow conditions (mean depth was 3.7 ft). The entire site was less than 5 ft deep. There was virtually zero gravel observed and the site had poor cover characteristics (very little vegetation, no boulders, and very shallow depths). No distinct temperature stratification or consistent vertical trends in DO concentration were observed in the profile data (Figure 39).



**Figure 39. Water quality profile data for site A55.4.**

Figure 40 provides an overview map of site A55.4. There are several problems with this site. The moderate score for DO may not be warranted based on the 24-h water quality data, which suggested that very low concentrations occur daily. The site is very shallow, which often leads to temperature problems, more rapid sedimentation in the long term, and limited cover or gravel for spawning. In addition, the water sample for this site had relatively high concentrations of aluminum (0.6 mg/L) and iron (0.37 mg/L).



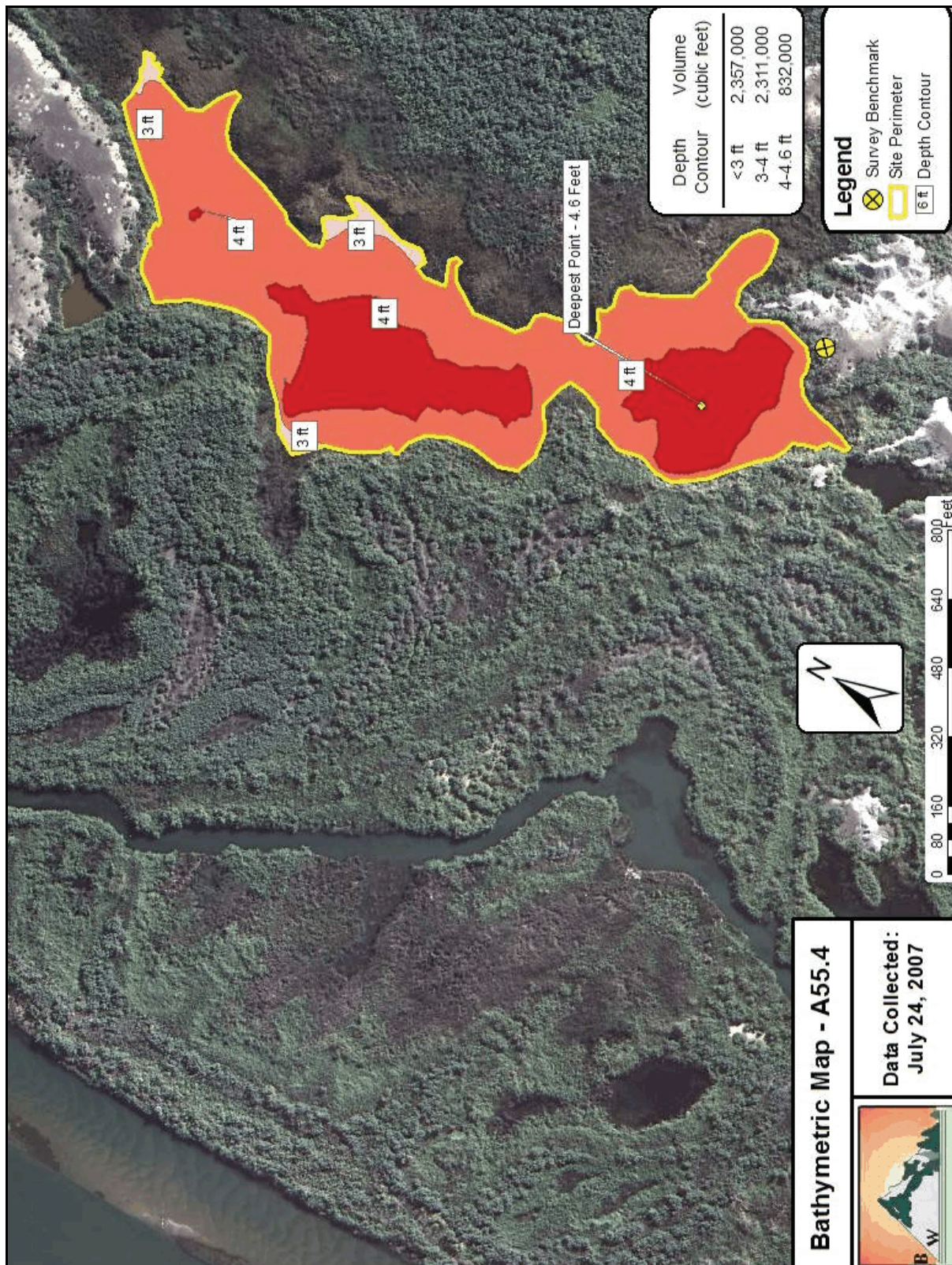


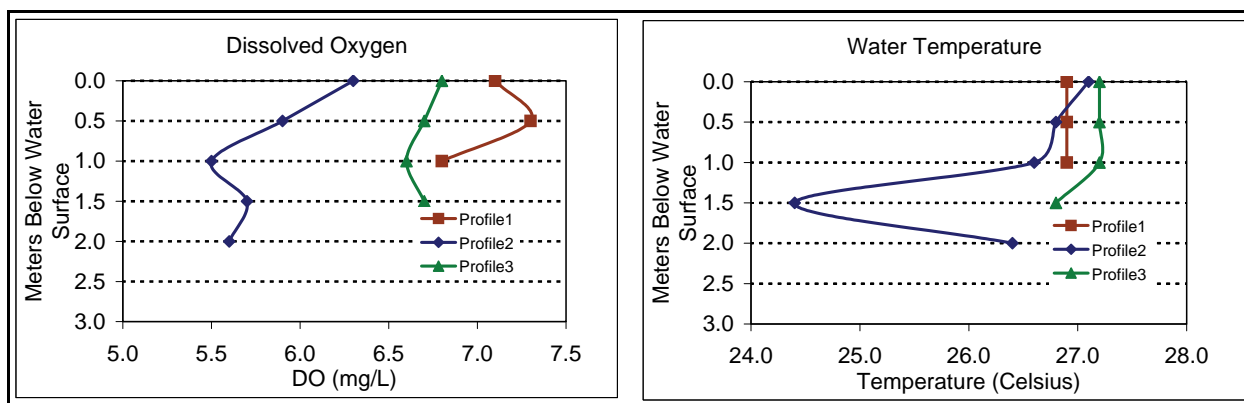
Figure 40. Bathymetric map of site A55.4.



### A54.3 - Excellent Rating

Site A54.3 was originally delineated at 3.2 acres but after collecting bathymetric data, the adjusted site dimensions resulted in an area of 4.9 acres. This site was connected to the river during field data collection. The SDI value of 1.56 indicates a relatively low shoreline complexity.

The total biological suitability criteria score for this site was 61, which gives it an excellent habitat creation opportunity rating. This site scored 40 out of 40 for water quality with an average DO value of 6.5 mg/L (24-h range of 3.5–8.5 mg/L), specific conductivity of 1245  $\mu\text{S}/\text{cm}$ , and average water temperature of 26.9°C (24-h range of 26.6–28.9°C). The mean depth of the site was 5.5 ft, but there was too much shallow (less than 5 ft) habitat to score in the high suitability range for that category. The amount of submergent vegetation was within the high suitability range and turbidity was a little too high to receive the top score. There was no distinct temperature or DO stratification observed in this site from the profile data (Figure 41).



**Figure 41. Water quality profile data for site A54.3.**

Figure 42 provides an overview map of site A54.3. Although this site received the highest score for DO concentration, the daily variation decreased into the moderate range. The only other concern with this site is the high percentage of shallow habitat. If hydraulically disconnected from the river, such characteristics could result in poor habitat conditions.

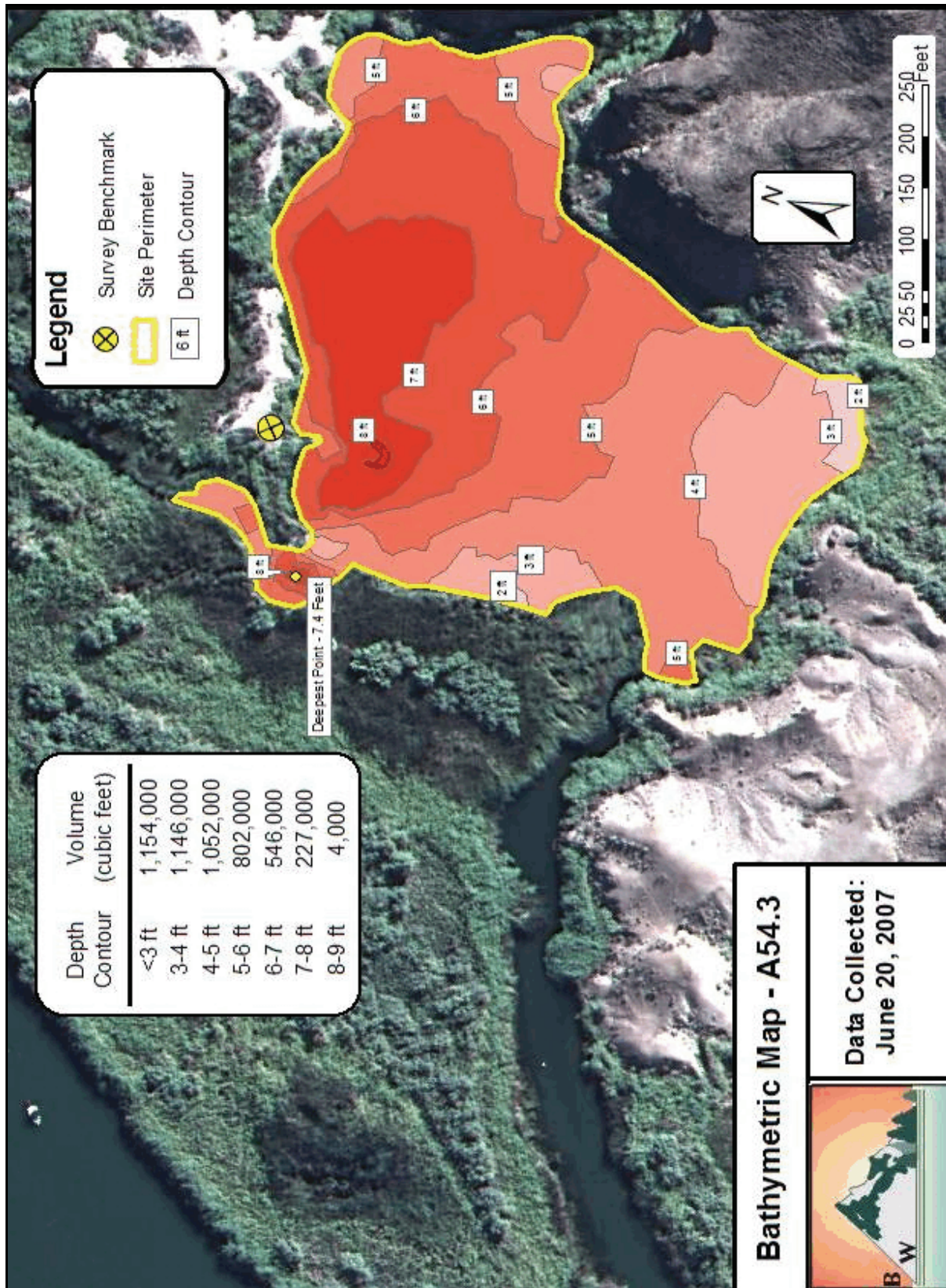
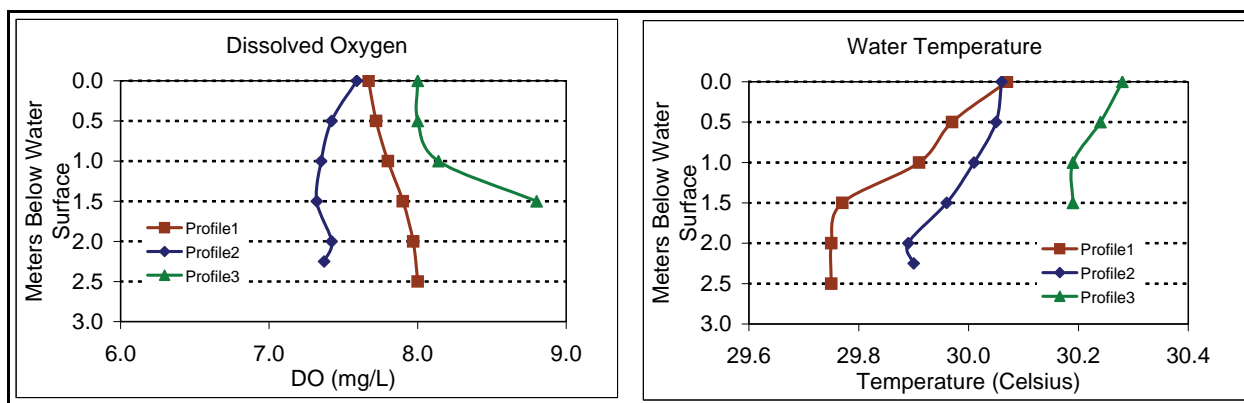


Figure 42. Bathymetric map of site A54.3.

## C53.5 - Excellent Rating

Site C53.5 is 5.6 acres and was one of the two sites that were originally listed as alternates. This site was selected to replace A69.7 pools A and B due to difficulty of access. The site was connected to the river during field data collection. The SDI value of 1.34 indicates a relatively low shoreline complexity.

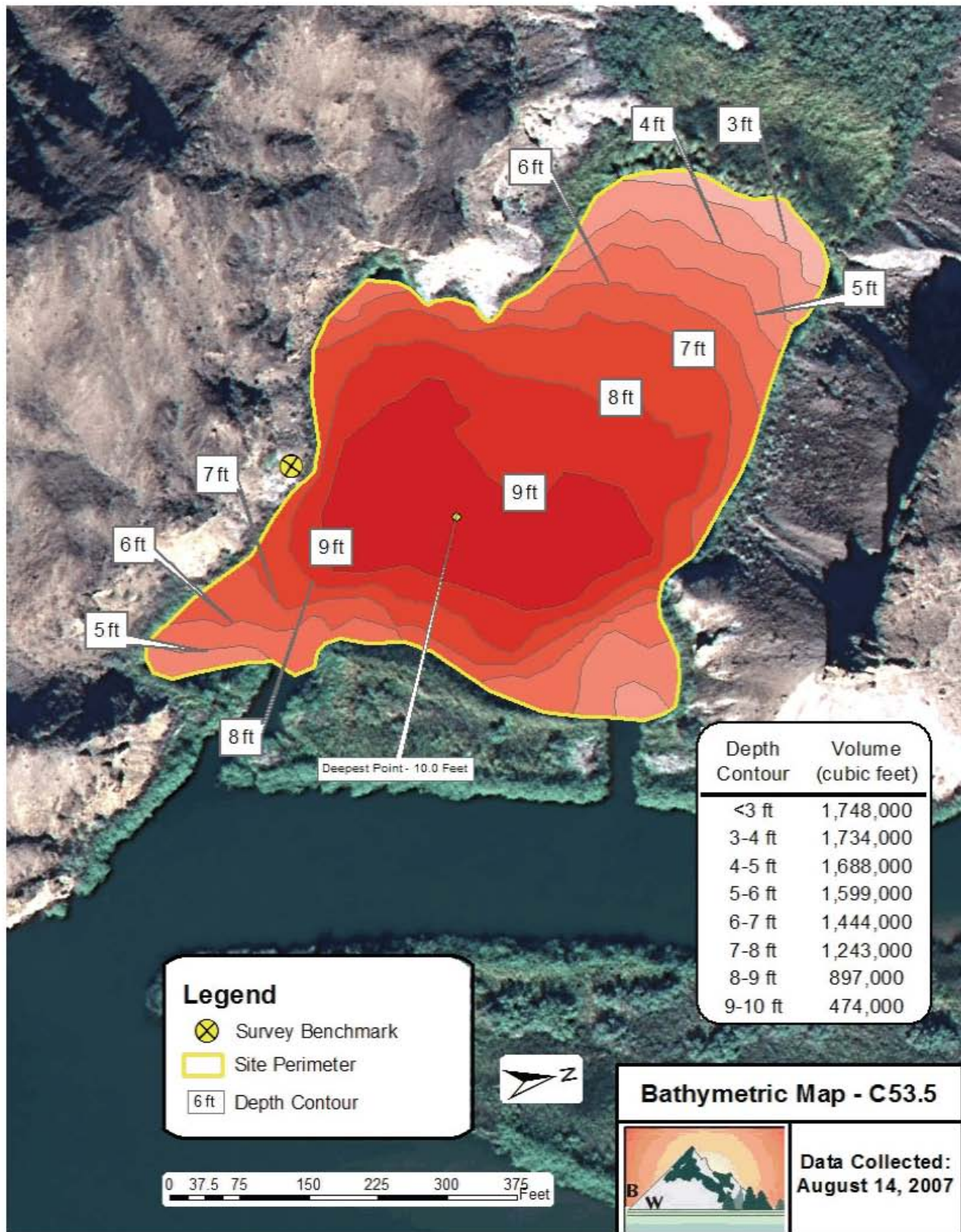
The total biological suitability criteria score for this site was 63, which gives it an excellent habitat creation opportunity rating. Water quality was very good with an average DO value of 7.8 mg/L (24-h range of 5.4–7.4mg/L), specific conductivity of 1315  $\mu\text{S}/\text{cm}$ , and a chlorophyll *a* concentration of less than 1.0  $\mu\text{g}/\text{L}$ . Average water temperature rated moderately suitable at 30.0°C (24-h range of 29.7–31.4°C). This was one of the deeper sites, averaging a depth of 7.2 ft; however, there was no area deeper than 10 ft. The site had good abundance of submergent vegetation, but moderate suitability for turbidity and no boulders. There was little vertical change in temperature or DO observed in the profile data (Figure 43).



**Figure 43. Water quality profile data for site C53.5.**

Figure 44 provides an overview map of site C53.5. This site appears to be a very good prospect with excellent DO characteristics and good depth (though no deep refuge). However, as with any site that is currently connected to the river and may be hydraulically isolated, changes in water quality conditions cannot be accurately predicted. Post-isolation monitoring should be conducted to determine whether water quality characteristics would remain within suitable ranges for native fish.



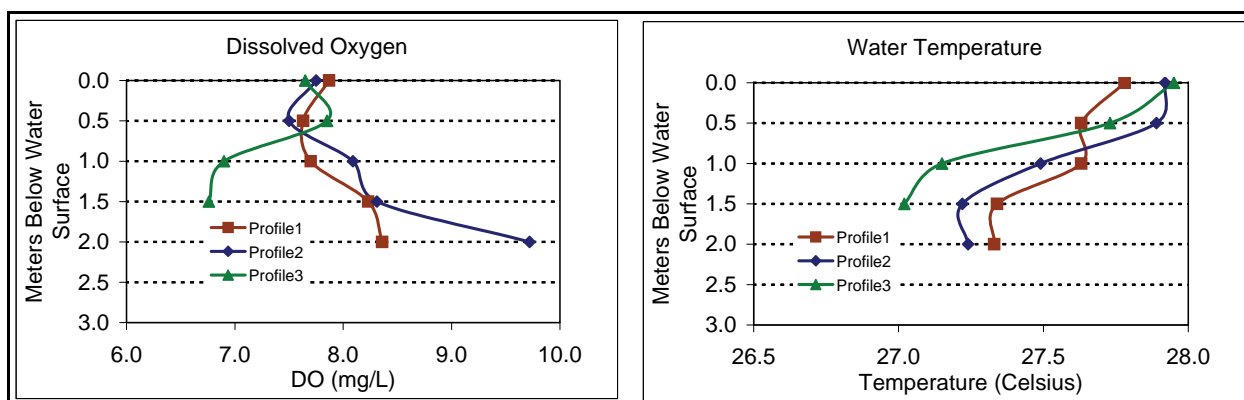


**Figure 44. Bathymetric map of site C53.5.**

## A53.4 - Excellent Rating

Site A53.4 is 5.2 acres and was directly connected to the river via a long, narrow channel that appeared to have been dredged to the site but had not been used in some time. The SDI value of 2.54 indicates a moderate shoreline complexity.

The total biological suitability criteria score for this site was 67, giving it an excellent habitat creation opportunity rating. Water quality was very good with an average DO value of 7.6 mg/L (24-h range of 4.0–11.0 mg/L), specific conductivity of 1228  $\mu\text{S}/\text{cm}$ , and no cyanobacteria observed in the algae sample. Average water temperature was slightly high at 27.4°C (24-h range of 27.8–30.6°C). The average depth for the site was 6.4 ft and only 19.4% was more shallow than 5 ft. Cover was very good for this site; gravel covered 22% of the shoreline, boulder-sized substrate and good amounts of submergent vegetation were present. No distinct temperature or DO stratification were observed at this site from the profile data (Figure 45).



**Figure 45. Water quality profile data for site A53.4.**

Figure 46 provides a closeup view of site A53.4 and Figure 47 provides an overview of the site and its connection to the river. This site appears to be a very good prospect. There may be some concern associated with the large variation in diel DO concentration and that should be evaluated carefully during seasonal sampling if this site is chosen. In addition, this site had a relatively high ammonia value in its water sample (0.23 mg/L), which could be a problem for native fish given the high toxicity of ammonia at higher pH levels (8.9 in this site) and higher water temperatures.



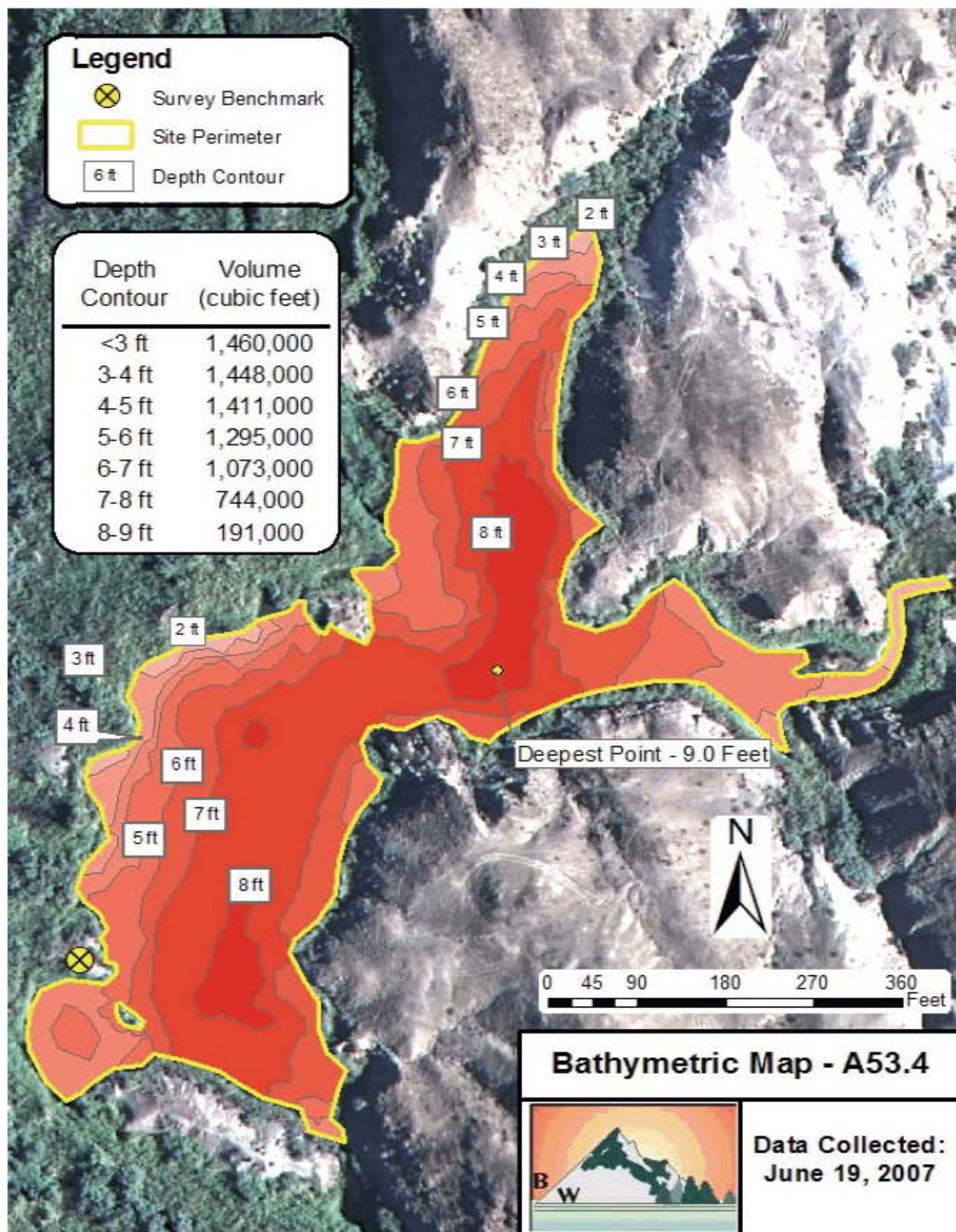
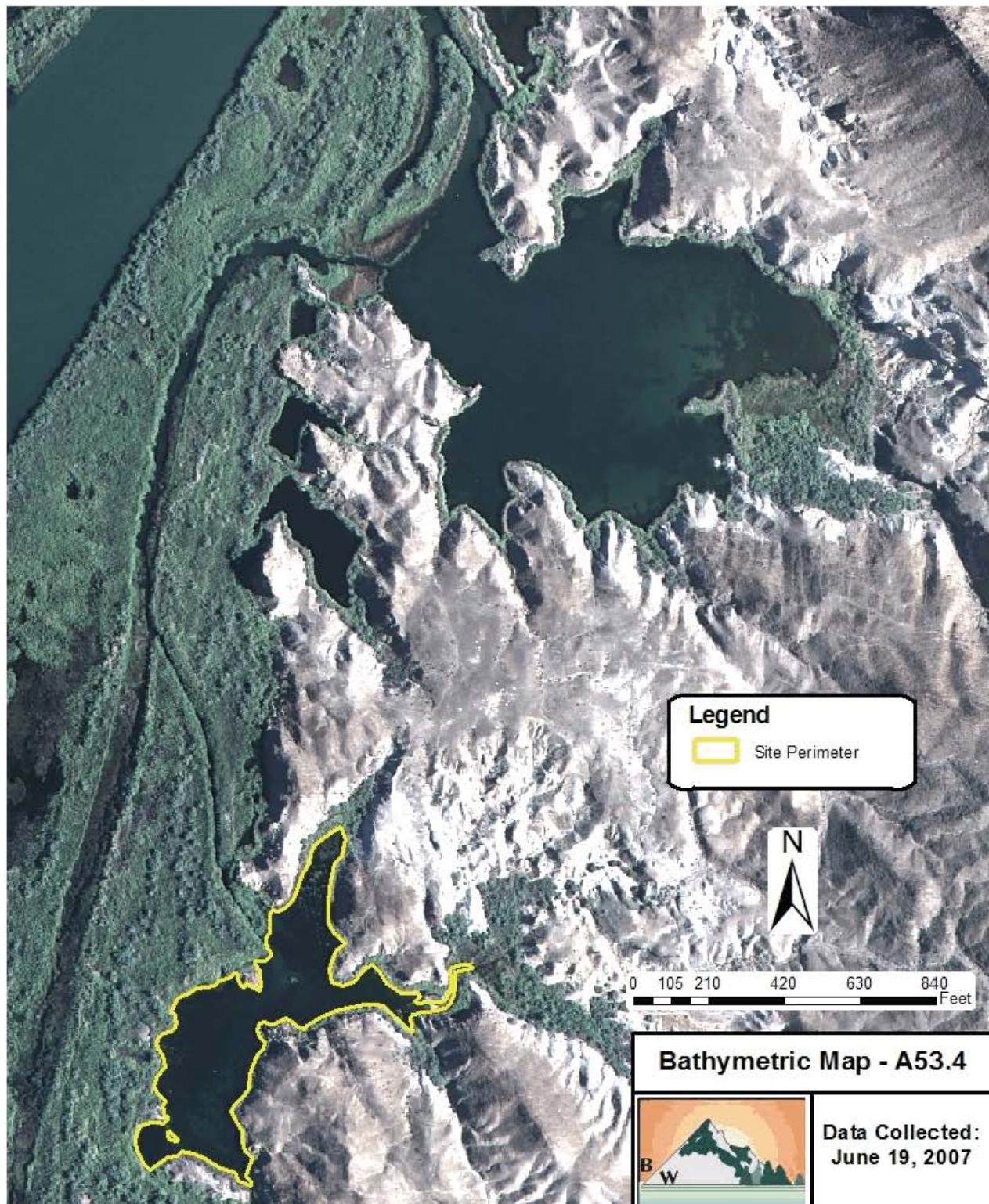


Figure 46. Bathymetric map of site A53.4.



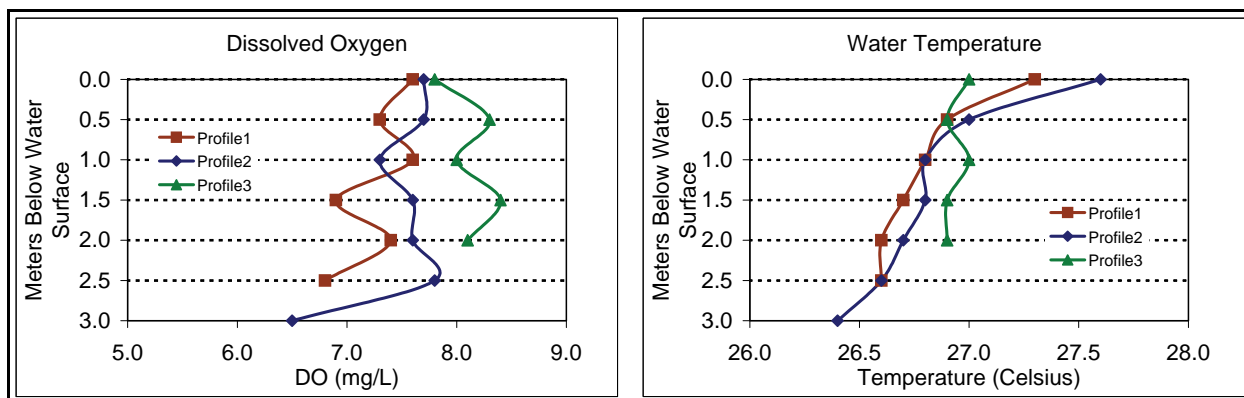


**Figure 49. Location of site A53.4 relative to the Lower Colorado River.**

## C52.5 - Excellent Rating

Site C52.5 is 7.1 acres and was connected to the river during field data collection. The SDI value of 2.05 indicates moderate shoreline complexity.

The total biological suitability criteria score for this site was 69, which gives it an excellent habitat creation opportunity rating. This site scored 40 out of 40 for water quality with an average DO value of 7.6 mg/L (24-h range of 6.0–9.2 mg/L), specific conductivity of 1276  $\mu\text{S}/\text{cm}$ , and average water temperature at 26.8°C (24-h range of 26.4–28.6°C). This site had a deep water refuge area, but it was too small (1.4% of the total area) to qualify for the high suitability score. Mean depth at the site was 6.6 ft. There was no evidence of large changes in temperature or DO concentration observed in this site from the profile data (Figure 48).



**Figure 48. Water quality profile data for site C52.5.**

Figure 49 provides an overview map of site C52.5. The only two apparent deficiencies in this site are low turbidity and not enough area of deep water refuge. Water quality was very good, which is likely because two large, short channels connect the site directly to the river, limiting residence time of water in this site. However, if there is a change in this connectivity to restrict non-native fish access to the site, there may be substantial changes to the water quality that are difficult to predict. Despite the uncertainty of changes in water quality, there are many beneficial characteristics in this site that are lacking in others, including having natural boulder-sized cover, some area that is deeper than 10 ft, good amounts of submergent vegetation, and sufficient gravel to support spawning. In all, site C52.5 appears to be a very good prospect.



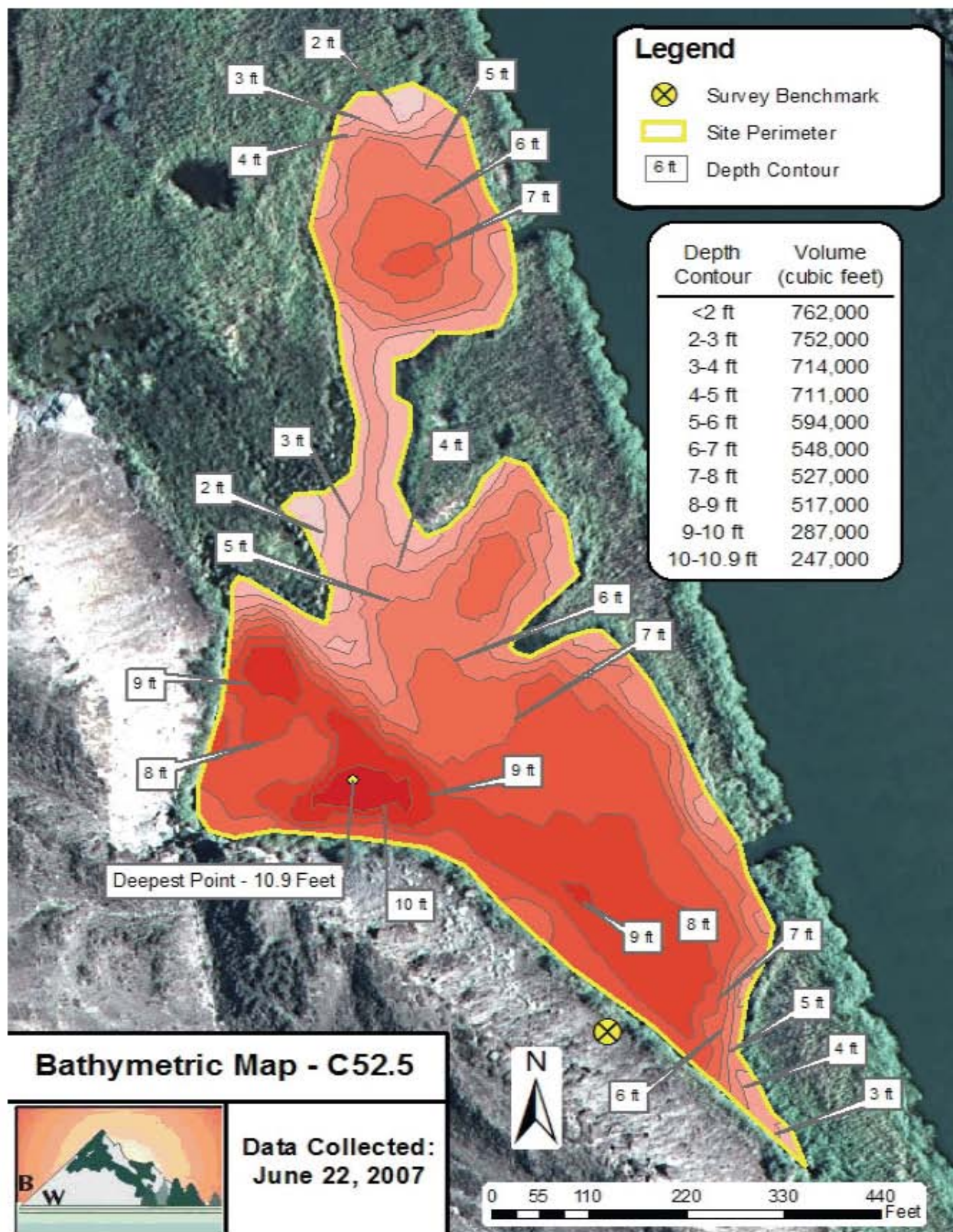


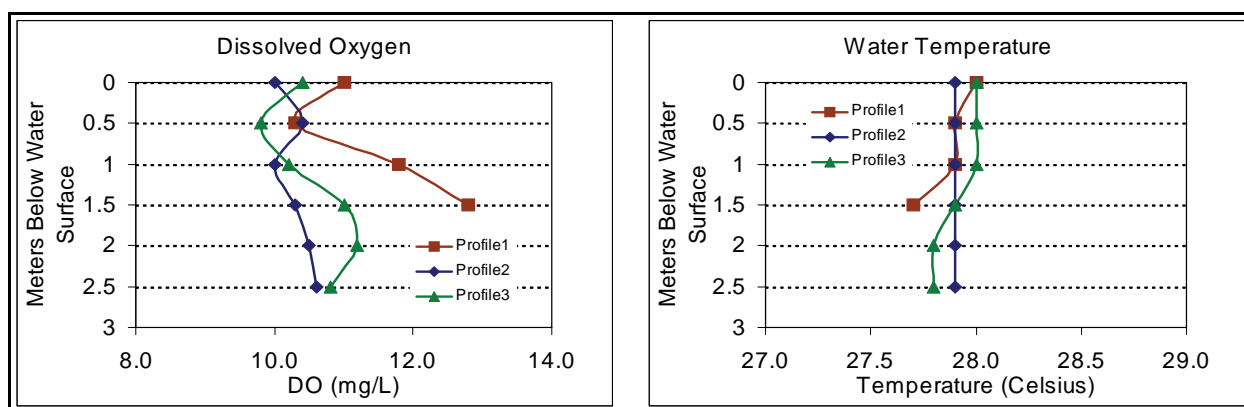
Figure 49. Bathymetric map of site C52.5.



## A51.4 - Excellent Rating

Site A51.4 is 10.8 acres and was directly connected to the river during field data collection. The SDI value of 2.45 indicates a moderate shoreline complexity.

The total biological suitability criteria score for this site was 67, which gives it an excellent habitat creation opportunity rating. Water quality was very good with an average DO value of 10.7 mg/L (24-h range of 7.6–13.5 mg/L) and specific conductivity of 1255  $\mu\text{S}/\text{cm}$ . Water temperature was slightly high at 27.9°C (24-h range of 27.5–29.5°C) and received a moderate score. Both categories in the spawning habitat section scored high with excellent quantities of gravel and only 22.1% of the area being more shallow than 5 ft. This site was also one of only two with a deep water refuge (27.2% of the total area) and had a mean depth of 7.6 ft. Turbidity was slightly too high to qualify for the highest score, as was vegetative cover, but boulder-sized cover was observed as well as many standing tree trunks. There was no evidence of temperature or DO stratification observed in this site from the profile data (Figure 50).



**Figure 50. Water quality profile data for site A51.4.**

Figure 51 provides an overview map of site A51.4. The biggest concern for this site is the abundance of submergent vegetation. While excellent for providing cover, it contributes to the large variation in DO concentration and may lead to seasonal problems if significant die-off occurs. This site may also have concerns with nutrients as it had the highest TKN measurement, at 2.2 mg/L and a relatively high ammonia concentration of 0.27 mg/L. With the high pH of the site (8.5) and water temperature, high ammonia could be toxic to fish. All other characteristics of this site are very good but may change with a modification of connectivity to the river to prevent non-native fish species from accessing the site. This site has a relatively long, narrow channel (approximately 0.5 mile) connecting it to the river which limits its direct exchange of water with the river and likely increases residence time of the water. With such conditions, the site is already closer to being “isolated” from the river than many other sites and may not change substantially if further restricted from its connection to the river.

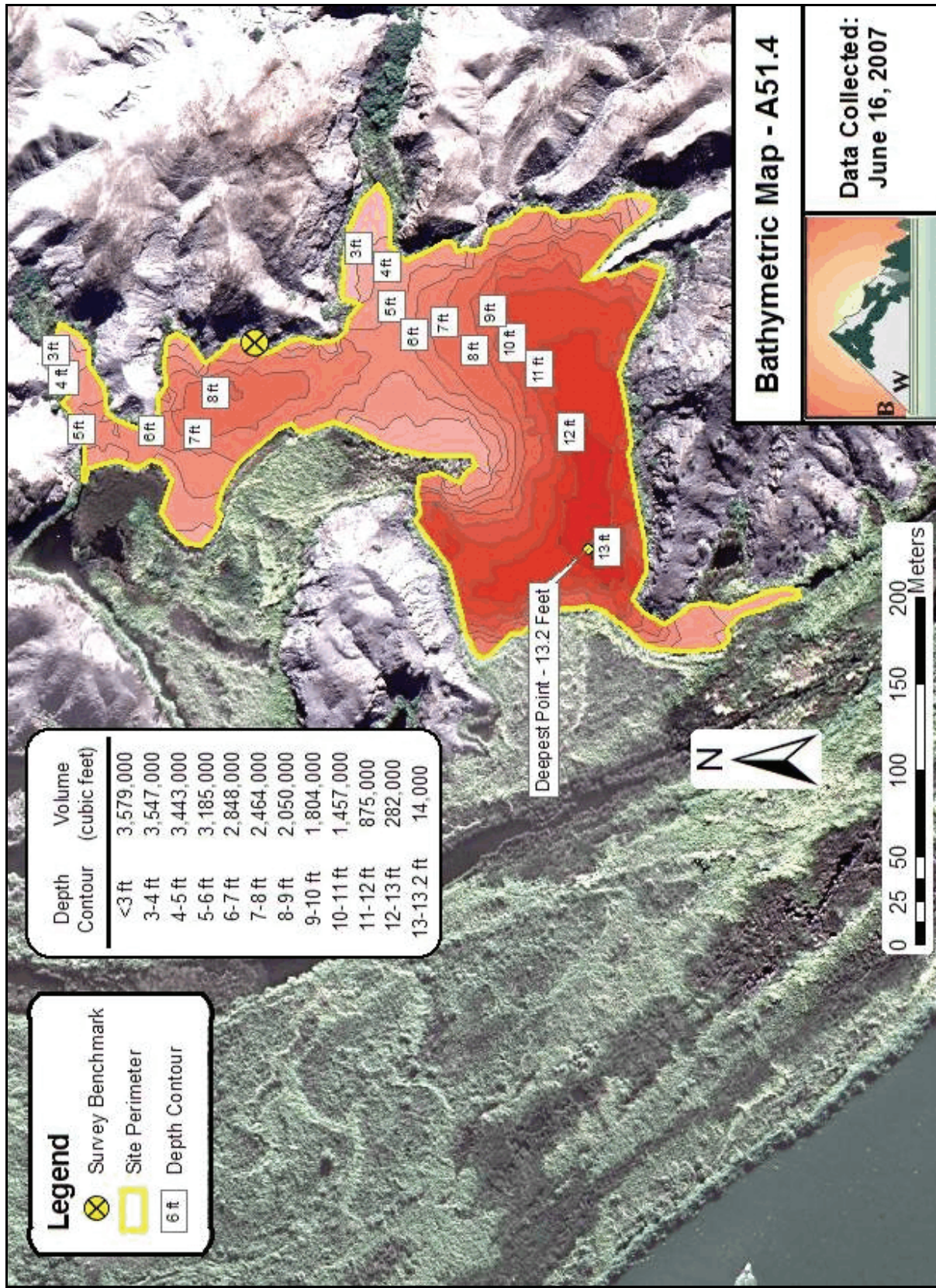


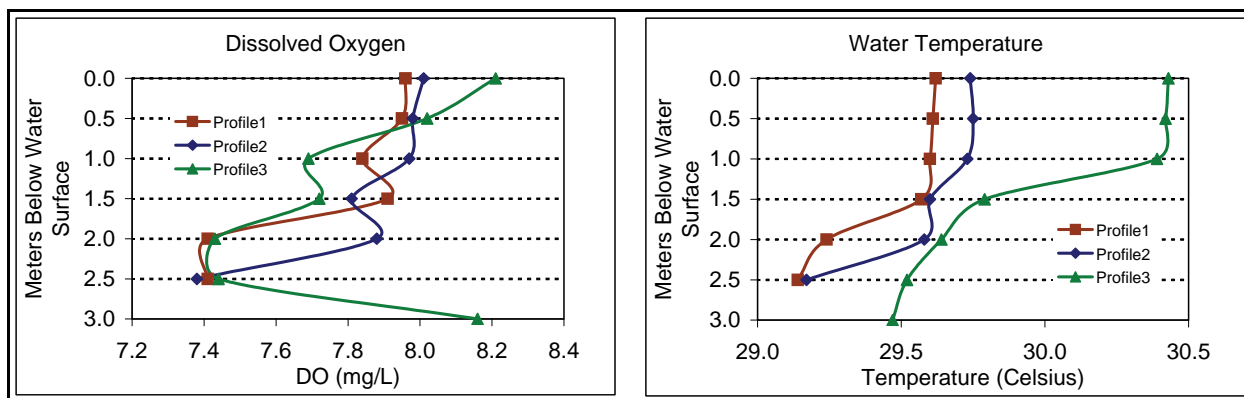
Figure 51. Bathymetric map of site A51.4.



## A49.2 - Excellent Rating

Site A49.2 was originally delineated at 8.5 acres, but after collecting bathymetric data, the adjusted site dimensions resulted in an area of 10.1 acres. The site appeared to be isolated from the river. The channel that appeared to have been dredged from the river to this site was silted in several places and water quality conditions (specifically conductivity) suggests that this site is more isolated from the river than other sites that had no obvious surface connection. The SDI value of 1.73 indicates a relatively low shoreline complexity.

The total biological suitability criteria score for this site was 63, which gives it an excellent habitat creation opportunity rating. Water quality was very good with an average DO value of 7.8 mg/L (24-h range of 5.9–8.5 mg/L) and specific conductivity of 2364  $\mu\text{S}/\text{cm}$ . Average water temperature was in the moderate suitability range at 29.6°C (24-h range of 29.1–31.0°C). The water sample from this site had the highest values for several parameters, including boron (0.92 mg/L), chloride (370 mg/L), fluoride (6.8 mg/L), and sodium (500 mg/L), and noticeably low values for calcium (40 mg/L) and magnesium (5.9 mg/L) compared with all other sites. The site had an average depth of 6.5 ft and had some deep water refuge (5.1%), but not enough to qualify for the high score in that category. Vegetative cover was lacking and turbidity was low at 1.84 NTU, but there was boulder-sized substrate observed as well as standing tree trunks and an area in the deepest part of the site with numerous tires in a pile. No distinct temperature or DO stratification was observed in this site from the profile data (Figure 52).



**Figure 52. Water quality profile data for site A49.2.**

Figure 53 provides an overview map of site A49.2. This site appears to be an excellent prospect to provide long-term habitat to razorback suckers and bonytail. It was isolated from the river during site examination, yet had good water quality conditions and good cover characteristics (including the tires, which do not factor into the scoring). The lack of vegetation does not appear to limit DO concentration, but may limit cover in this clear site. The other cover features help, but additional cover may be desirable. There were some interesting dynamics in the water quality sample, but none that were of great concern.

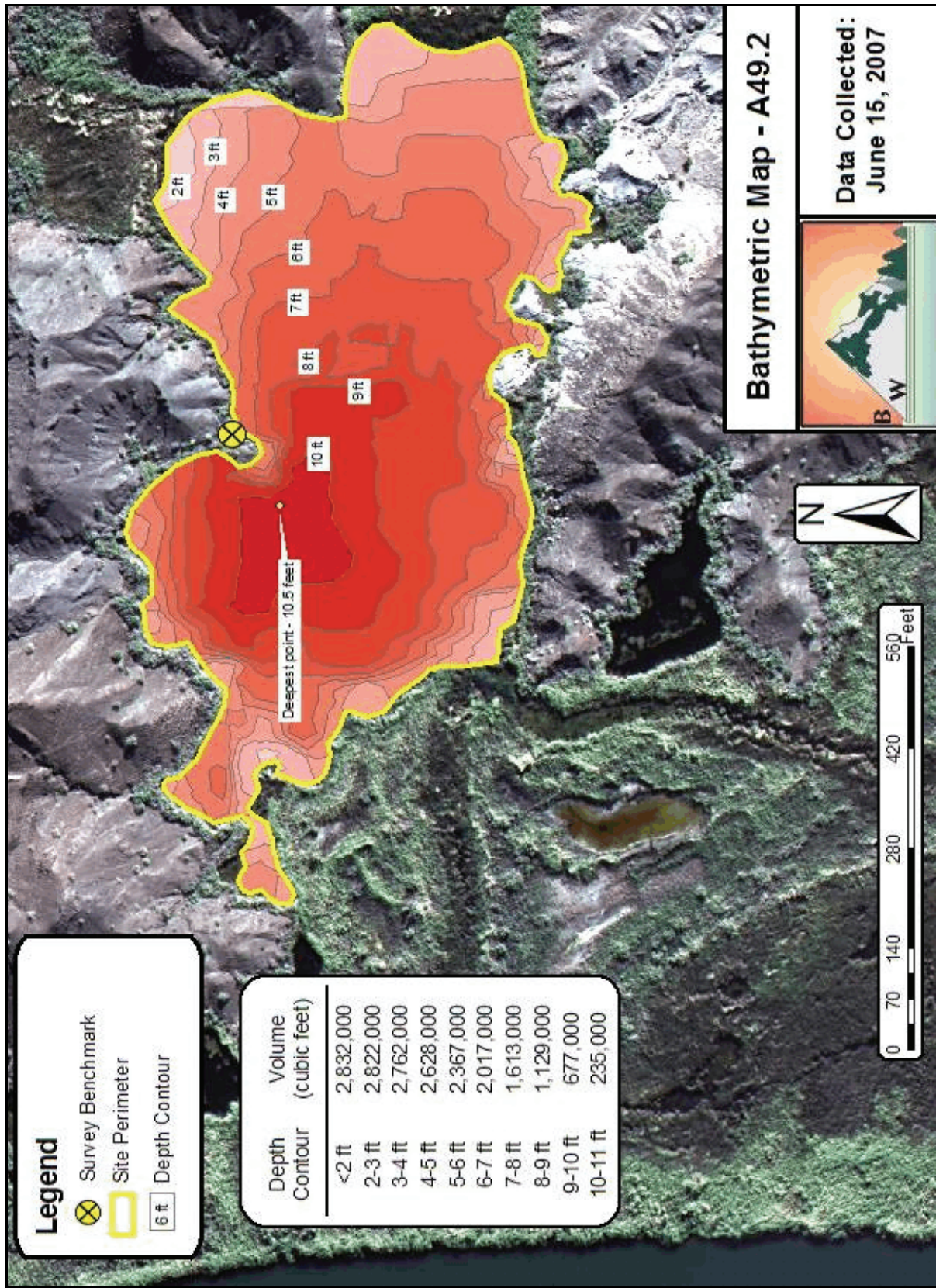


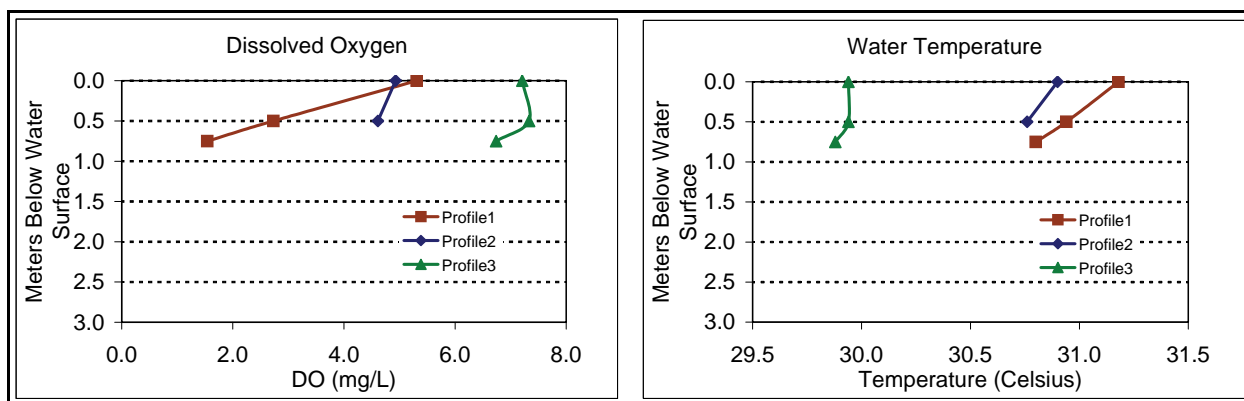
Figure 53. Bathymetric map of site A49.2.



## C48.5 (West Pond) - Moderate Rating

Site C48.5 is 50.2 acres and appeared to be isolated from the river during field data collection. A small channel appeared to lead to the site from the upstream dam and may be periodically used to send water (and potentially non-native fish species) into the site. However, the specific conductivity value (2,137  $\mu\text{S}/\text{cm}$ ) suggests that the site may not receive substantial inflows from this source. The SDI value of 2.28 indicates a moderate shoreline complexity; the large pool was relatively round (i.e., would have low SDI), but the site included a separate small pool and the channel, both of which influenced the overall SDI value.

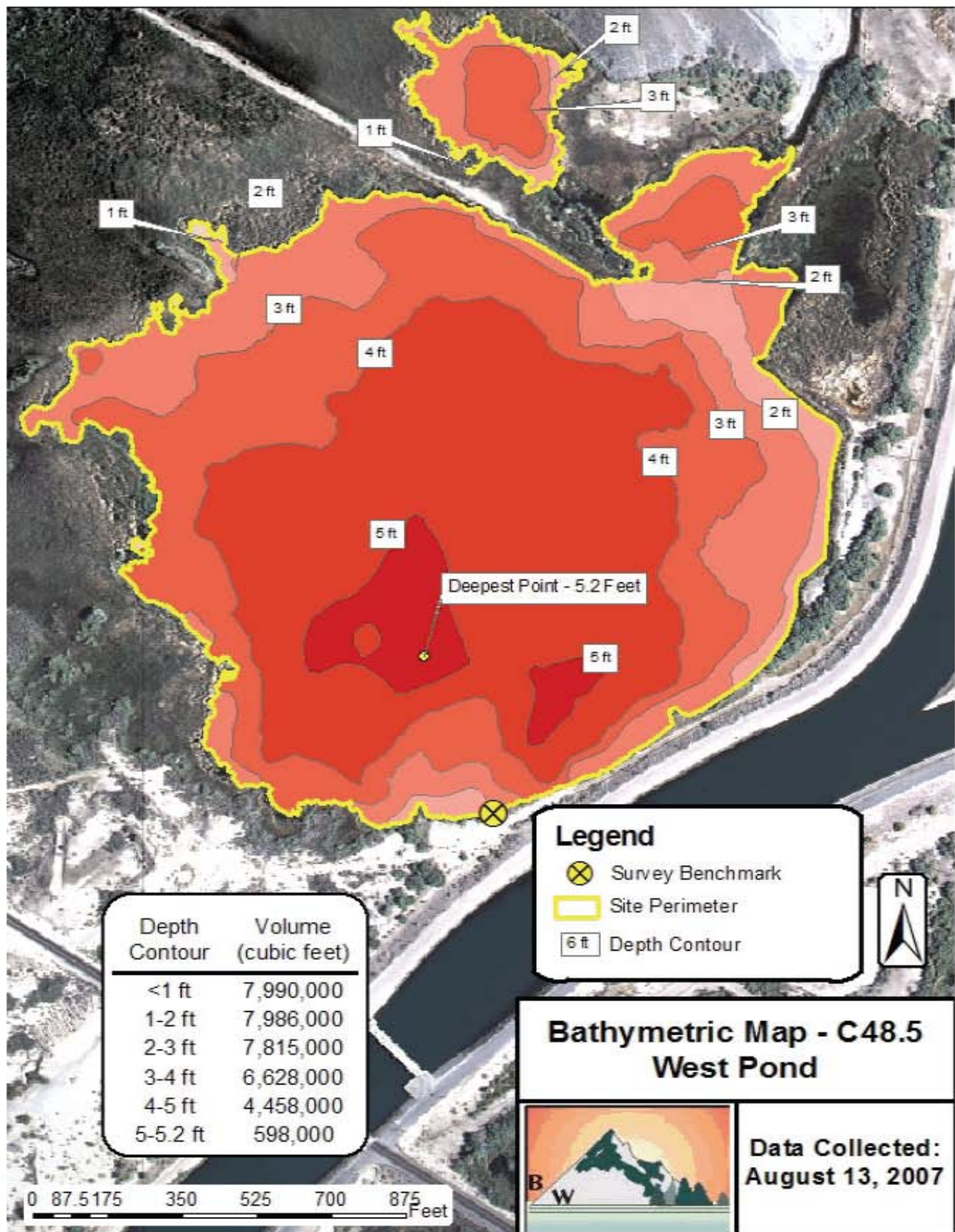
The total biological suitability criteria score for this site was 50, which gives it a moderate habitat creation opportunity rating. Water quality was good, but the average DO value (4.89 mg/L) and water temperature (30.6°C) were in the moderate scoring range. The 24-h water quality data suggest that DO declines to very low values daily (range of 1.9–8.6 mg/L); temperature ranged from 29.4–30.6°C. The water sample yielded a high total organic carbon value (9.8 mg/L), which indicates a buildup of detritus and promotes rapid ecological succession. There were also high concentrations of boron (0.42 mg/L), potassium (17.0 mg/L), silica (49.0 mg/L), and sodium (300 mg/L). This site was very shallow with a mean depth of 3.7 ft and 96.6% percent of the area more shallow than 5 ft. There was plenty of gravel to support spawning, but the submergent vegetation was very abundant (91.2% of the area), dense, and grew to the water surface in most areas. Water quality observations were collected in some of the small area that had open water, but the field crews observed that water temperature was much higher within dense vegetation. Other than dense vegetation, the cover attributes were poor, with no boulders, low turbidity, and no deep areas. No temperature or DO stratification was observed in this site from the profile data (Figure 54).



**Figure 54. Water quality profile data for site C48.5.**

Figure 55 provides an overview map of site C48.5. This site had physical characteristics that may limit the success of habitat creation efforts here. The dense submergent vegetation (spiny naiad) could cause seasonal DO fluctuations. Combined with shallow conditions, this will hasten

sedimentation and biological oxygen demand of the detritus. There is already great daily variation in DO concentration that drops the level into poor suitability conditions. Dredging would likely be required to allow this site to function as suitable habitat for native fishes.



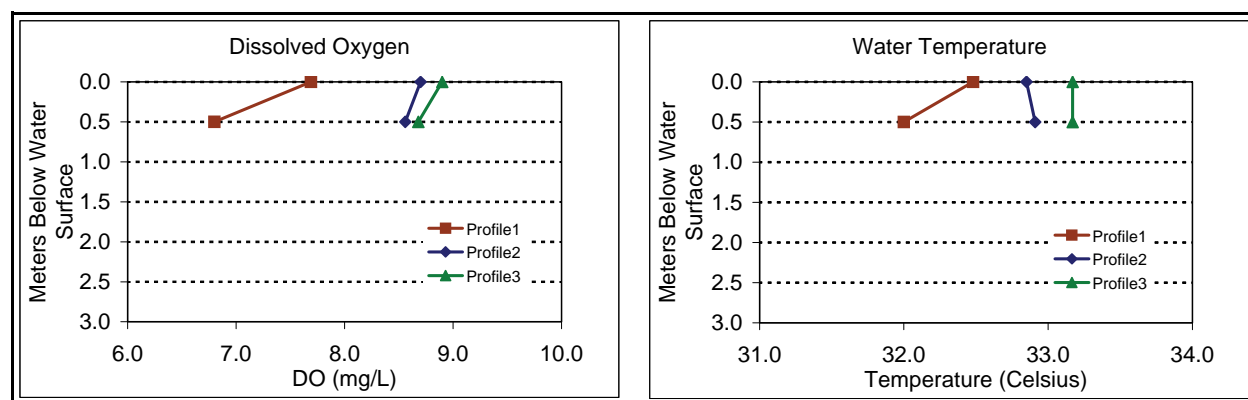
**Figure 55. Bathymetric map of site C48.5.**



## C48.2 (Horseshoe Pond) - High Rating

Site C48.2 is 4.9 acres and was isolated from the river during field data collection, but the average specific conductivity value (1,903  $\mu\text{S}/\text{cm}$ ) suggests that some subsurface exchange of water may exist (seepage from the adjacent All American Canal). The SDI value of 1.98 indicates a low to moderate shoreline complexity.

The total biological habitat suitability score for this site was 53, which gives it a high habitat creation opportunity rating. Water quality was good with an average DO value of 8.0 mg/L (24-h range of 5.0–9.2 mg/L), specific conductivity of 1903  $\mu\text{S}/\text{cm}$ , and low chlorophyll *a* concentration. Water temperature was very high at 32.7°C (24-h range of 31.7–35.1°C), largely due to the shallow conditions (mean depth was 2.2 ft). The water sample from this site yielded a relatively high total organic carbon value (5.7 mg/L), which indicates a buildup of detritus and promotes rapid ecological succession. There were also relatively high phosphorus (9.5 mg/L), potassium (16 mg/L), silica (58 mg/L), and sodium (260 mg/L) concentrations compared with other sites. The entire site was less than 5 ft deep and no area was greater than 10 ft, giving it a low score in both depth categories. In addition to being shallow and hot, there was limited cover available to fish (no submergent vegetation or boulders and no deep refuge). No distinct temperature or DO stratification was observed in this site from the profile data (Figure 56).



**Figure 56. Water quality profile data for site C48.2.**

Figure 57 provides an overview map of site C48.2. The very shallow nature of this site and resulting high temperature are serious concerns to its suitability for native fish. In addition there is a distinct lack of cover in this clear site and fish would be restricted to using just a small area along the shoreline without additional cover. The other water quality parameters were better than expected in this isolated site and suggest a good subsurface connection with the river. Cyanobacteria counts were fairly high (33.7%) and would have to be monitored to ensure it does not become a problem, but as is, the counts were well within the high suitability range. Because of its extremely shallow nature and high organic composition dredging would likely be required to allow this site to function as suitable habitat for native fishes.

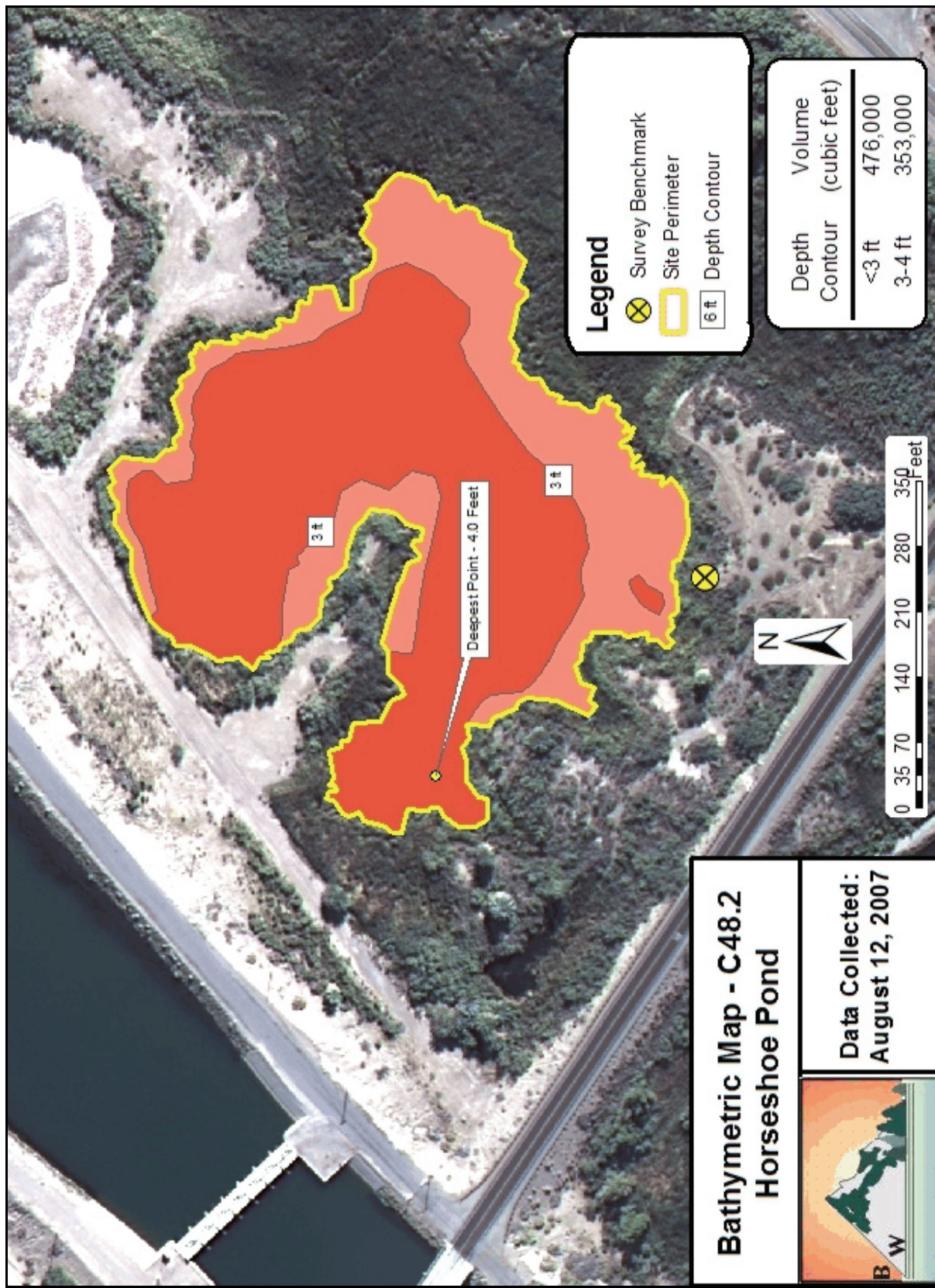


Figure 57. Bathymetric map of site C48.2.

## DISCUSSION AND RECOMMENDATIONS

The 25 sites from LCR MSCP Reaches 5 and 6 that were evaluated in this effort had many similarities, but each had a unique combination of physical and water quality characteristics that will help determine which are best suited to further evaluation and ultimately habitat creation efforts for razorback sucker and bonytail. Some sites were very close to being ideal candidates with little work necessary before native fish could be introduced, while others appear to require extensive efforts. Many of the sites that rated highest and appeared to be excellent prospects are currently connected to the river, which contributes to their excellent water quality conditions. If such sites were to have their surface connection restricted to prevent access by non-native fish species, the water quality conditions will change in unpredictable ways. Those that are physically closer to the river are more likely to receive good subsurface exchange of water with the river, though even this is difficult to predict because of soil conditions and other variables that influence the seepage characteristics in different locations.

A few sites appeared to be very good candidates even though there was no obvious surface connection. Most of these sites had abundant and diverse non-native fish populations and good to excellent water quality conditions. These characteristics suggest that there could be an unobserved surface connection to some or all of these sites (the emergent cattails and water reed was often very dense and could have obstructed view of an existing channel). However, Prieto (1998) suggests that such sites may be pseudo-seeps with no distinct surface connection and very good water quality characteristics via subsurface connections. Because most of these sites were very close to the river, it would be logical for subsurface water exchange to occur. If some or all of these sites can be evaluated to determine conclusively whether they are truly isolated from the river with no surface connection, yet able to maintain the existing water quality characteristics, then these could be very good opportunities to explore as habitat conservation areas. Though many rated “high” rather than “excellent” in habitat creation opportunity, there would be less uncertainty associated with changes in water quality that may occur with a site that is currently rated as “excellent” but must have its connection to the river restricted in some way to prevent non-native fish species access.

As expected, many of these floodplain lakes are shallow, often with a mean depth of less than 6 ft. The shallowest of these sites tended to have high water temperatures. Also, sites that were more isolated had greater water quality issues, but such conditions may result if a connected site is modified to substantially reduce connectivity to the river. The benefit of using an isolated site is that water quality conditions can be improved with some (screened) connection to the river established. With a currently connected site, conditions are likely already very good and with careful management could be maintained, even with a restriction on the connectivity to the river. However, it is difficult to predict just how much change could be anticipated in any given site.

We believe that these ratings give a good start, but there are issues that should be individually examined. Nearly all sites that had an excellent habitat creation opportunity rating appear to be good prospects and the individual characteristics of the sites in that group that are not readily



apparent in the scoring system (e.g., great variation in diel DO concentration) can be used to further sort the best sites for further evaluation. Sites that rated as high in habitat creation opportunity each had slightly more cause for concern, as noted in the site-specific results, and would likely require more effort to establish native fish habitat; but these sites are, in many cases, still good prospects. In particular, we believe that sites A67.9, C67.6b, C64.4, and C62.9 are among those in the high rating category that may warrant a closer look. Both sites A67.9 and C64.4 were limited in vegetative cover and depth, but they still scored high. Sites C67.7b and C62.9 had dense vegetative cover that could potentially increase the BOD as the vegetation senesces in the fall. Vegetation may need to be established or controlled by some means, such as dredging, to increase depth and stabilize the diel variations in DO concentration. Sites that scored low or moderate have many issues that would cause problems and/or require excessive effort to correct. These sites should be considered only when logistics dictate that one of these sites is more desirable than the higher rated sites, or if further evaluation substantially reduces the list of available high and excellent rated sites. More detailed explanations of site suitability and issues associated with each site that may not be represented in the habitat suitability score can be found in the site-specific results section.

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## GLOSSARY OF TERMS

**Differential correction:** GPS signals are collected at a base station (with precisely known coordinates) at the same time that GPS signals are collected (must be from the same satellites) in the field. The base station data are used to calculate error in the GPS signals at the time that the field data are collected and these calculations used to correct the field data.

**Echosounder:** A device that uses sound pulses directed from the water surface vertically down to measure the distance to the bottom by means of sound waves.

**Glutaraldehyde:** A colorless liquid with a pungent odor used as a chemical preservative.

**Nephelometric Turbidity Units (NTU):** The standard unit of measure of water turbidity; a nephelometer or turbidimeter is used to measure the intensity of light scattered at 90 degrees as a beam of light passes through a water sample.

**Van Dorn beta bottle:** A device that provides a means of collecting water samples at selected depths below the surface. It is made of an open-ended plastic cylinder that can be attached to a wire and lowered to any desired depth, when the latch is triggered to close the endcaps and trap the water sample for retrieval.





## **APPENDIX A:      BENCHMARK LOCATIONS**

**Table A: Reaches 5 and 6 inventory sites benchmark locations (GPS locations in UTM Nad83).**

<b>SITE</b>	<b>WSE (FT BELOW BM ELEV)</b>	<b>NORTHING</b>	<b>EASTING</b>
A69.7c	-5.092	3657805.258	721391.914
A67.9	-3.942	3657288.850	722633.906
C67.6a	-6.717	3656857.367	725713.681
C67.6b	-4.242	3657347.992	726044.870
A67.5	-5.000	3657076.000	723940.000
C65.0	-1.283	3657664.246	726778.238
A64.5	-6.060	3657933.000	728193.000
C64.4	-8.333	3657622.000	728172.000
C64.1	-15.854	3657524.128	728825.896
A63.8	-5.408	3657515.158	729256.005
A63.7	-8.100	3657904.902	729220.285
A62.9	-4.850	3657475.495	729903.979
A62.3	-8.033	3657659.197	731921.863
A59.7	-5.920	3654213.000	734563.000
C57.6a	-6.125	3653517.000	732657.000
C57.6		No Suitable Location	
A55.4	-10.950	3649347.000	737580.000
A54.3	-4.767	3648119.000	736465.000
C53.5	-10.430	3647135.028	735316.966
A53.4	-4.680	3646743.020	736076.440
C52.5	-11.958	3645612.750	735728.400
A51.4	-4.683	3645367.000	737049.000
A49.2	-2.775	3643715.000	737743.000
C48.5	-3.060	3640230.391	736007.891
C48.2	-8.920	3639900.000	736141.000





**APPENDIX B: BIOLOGICAL SUITABILITY CRITERIA  
WORKSHEETS**

# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: 169.7c Location/Reach: 5

Channel Formation Type: flood plain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR, TE Date: 7/8/07

Shoreline Development Index Value: 1.19 Backwater Size 2.4

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>9.35</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>-</u>	<u>-</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>30.0</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1146</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>8.23</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>0.567</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>42.7</u>	<u>5</u>

WATER QUALITY SCORE: 38

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>82.0</u>	<u>1</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>21.0</u>	<u>5</u>

SPAWNING HABITAT SCORE: 6

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.



# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: 169.7c

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>65.9</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>2.7</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>1</u>	<u>1</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 6

## BIO-INDICATORS:

- |  |   |
|--|---|
| (1) Fish present (except Gambusia or bullhead) | 5 |
| (2) Fish absent                                | 1 |

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 55

## Additional Notes:

Evidence of water exchange: direct connect to river via channel

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

few tree trunks

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: A67,9 Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): HR, CU, TE Date: 7/9/07

Shoreline Development Index Value: 3.57 Backwater Size 27.6

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>5.60</u>	<u>5</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>28.12</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1117</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>8.0</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>0.724</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>37.6</u>	<u>5</u>

WATER QUALITY SCORE: **33**

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>51.7</u>	<u>1</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>4.8</u>	<u>1</u>

SPAWNING HABITAT SCORE: **2**

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: A67.9

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>2.7</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>6.0</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>0</u>	<u>5</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 10

<u>BIO-INDICATORS:</u>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 50

## Additional Notes:

Evidence of water exchange: connected via channel to river

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

many standing tree trunks, undercut banks below phragmites

Other observations:

The two pools were connected via a channel

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: C67.6a Location/Reach: 5

Channel Formation Type: flood plain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR, RR, TS Date: 7/28/07

Shoreline Development Index Value: 1.53 Backwater Size 3.2

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>4.59</u>	<u>3</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>-</u>	<u>-</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>31.36</u>	<u>1</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1355</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>7.53</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>0.516</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>0</u>	<u>5</u>

WATER QUALITY SCORE: 29

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>100</u>	<u>1</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>3.5</u>	<u>1</u>

SPAWNING HABITAT SCORE: 2

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

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Backwater Number: C67.6a

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>&lt;10</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>2.4</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>A</u>	<u>1</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 6

<b><u>BIO-INDICATORS:</u></b>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 42

## Additional Notes:

Evidence of water exchange: direct connection

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

beaver dam in access channel, standing tree trunks

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: C67.6b Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR, RR, TS Date: 7/27/07

Shoreline Development Index Value: 1.53 Backwater Size 4.6

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>8.94</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>-</u>	<u>-</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>30.22</u>	<u>3</u>
Salinity	(1) <5,000 ( $\mu$ S/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>12.58</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>8.18</u>	<u>5</u>
Selenium	(1) <2 $\mu$ g/L	5		
	(2) >2	1	<u>40.025</u>	<u>5</u>
Chlorophyll a	(1) <50 ( $\mu$ g/L)	5		
	(2) >50	1	<u>0.536</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>0</u>	<u>5</u>

WATER QUALITY SCORE: **38**

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>33.3</u>	<u>5</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>37.0</u>	<u>5</u>

SPAWNING HABITAT SCORE: **10**

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.



# Biological Suitability Criteria Worksheet

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Backwater Number: 067.6b

## COVER:

Vegetation	(1) 10-60% (pond's area)	5	<u>&gt;60</u>	<u>1</u>
	(2) <10%	1		
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5	<u>6.7</u>	<u>3</u>
	(2) 0-10; 101-150	3		
	(3) >150	1		
Rip-Rap	(1) Present	5	<u>A</u>	<u>1</u>
	(2) Absent	1		
Depth >10feet	(1) 15-35% (of pond)	5	<u>0</u>	<u>1</u>
	(2) >35%	3		
	(3) <15%	1		

COVER SCORE:

6

## BIO-INDICATORS:

- |  |   |
|--|---|
| (1) Fish present (except Gambusia or bullhead) | 5 |
| (2) Fish absent                                | 1 |

BIO-INDICATORS SCORE:

5

TOTAL SCORE (sum of all items):

59

## Additional Notes:

Evidence of water exchange: No distinct channel but an area was observed that may have allowed a surface connection

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

standing tree trunks, some scattered large cobble/boulder, but not enough to qualify as rip-rap

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: A67.5 Location/Reach: 5

Channel Formation Type: flood plain depression

Backwater Type (circle one): Connected Isolated

Observer(s): HR, TE Date: 7/7/07

Shoreline Development Index Value: 1.33 Backwater Size 2.2

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>4.41</u>	<u>3</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>30.7</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1242</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>7.44</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>0.524</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>50.8</u>	<u>1</u>

WATER QUALITY SCORE: 27

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>82.2</u>	<u>1</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>16.5</u>	<u>5</u>

SPAWNING HABITAT SCORE: 6

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: A67.5

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>5.7</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>4.2</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>A</u>	<u>1</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 6

<b><u>BIO-INDICATORS:</u></b>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 44

## Additional Notes:

Evidence of water exchange: (dredge) direct channel to river

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

\_\_\_\_\_

Other observations:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: 665.0 Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR, TE Date: 7/11/07 - 7/12/07

Shoreline Development Index Value: 2.88 Backwater Size 17.5

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>5.37</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>-</u>	<u>-</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>28.61</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1191</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>7.66</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>60.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>0.949</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>44</u>	<u>5</u>

WATER QUALITY SCORE: 38

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>31.8</u>	<u>5</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>5.1</u>	<u>5</u>

SPAWNING HABITAT SCORE: 10

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.



# Biological Suitability Criteria Worksheet

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Backwater Number: C65.0

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>57.8</u>	<u>5</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>7.1</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>P</u>	<u>5</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 14

<b><u>BIO-INDICATORS:</u></b>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 67

## Additional Notes:

Evidence of water exchange: directly connected <sup>to river</sup> via deep channel (>1 meter deep)

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

fewer standing tree trunks than other sites

Other observations:

little evidence of <sup>recent</sup> recreational use because channel was  
overgrown

# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: A64.5 Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR, MC Date: 8/11/07

Shoreline Development Index Value: 1.24 Backwater Size 4.3

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>2.28</u>	<u>-</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>2.81</u>	<u>1</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>29.85</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1384</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>7.77</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>8.33</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>57.4</u>	<u>1</u>

WATER QUALITY SCORE: **25**

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>33.8</u>	<u>5</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>25</u>	<u>5</u>

SPAWNING HABITAT SCORE: **10**

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

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Backwater Number: 164.5

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>54.7</u>	<u>5</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>13.9</u>	<u>5</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>P</u>	<u>5</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 16

<b><u>BIO-INDICATORS:</u></b>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 56

## **Additional Notes:**

Evidence of water exchange: direct channel to river

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

Several standing tree trunks

Other observations:

dense submerged vegetation through much of the site

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: 664.4 Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected (Isolated)

Observer(s): MR, TE Date: 8/10/07

Shoreline Development Index Value: 2.31 Backwater Size 7.8

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>6.23</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>-</u>	<u>-</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>30.18</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1364</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>7.59</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>1.595</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>28.4</u>	<u>5</u>

WATER QUALITY SCORE: **38**

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>12.1</u>	<u>5</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>8.8</u>	<u>5</u>

SPAWNING HABITAT SCORE: **10**

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.



# Biological Suitability Criteria Worksheet

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Backwater Number: C64.4

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>4.5</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>6.8</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>A</u>	<u>1</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 6

<u>BIO-INDICATORS:</u>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 59

## Additional Notes:

Evidence of water exchange: None observed

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

few standing tree trunks

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: 664.1 Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR, TS Date: 7/21/07

Shoreline Development Index Value: 1.49 Backwater Size 3.8

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>5.30</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>-</u>	<u>-</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>31.80</u>	<u>1</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1477</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>7.86</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>40.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>2.684</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>0</u>	<u>5</u>

WATER QUALITY SCORE: 36

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>92.4</u>	<u>1</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>12.5</u>	<u>5</u>

SPAWNING HABITAT SCORE: 6

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

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Backwater Number: C64.1

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>0</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>4.8</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>11</u>	<u>1</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 6

<u>BIO-INDICATORS:</u>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 53

## Additional Notes:

Evidence of water exchange: None, appeared isolated

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

standing tree trunks

Other observations:

Total depth at hydrolab sites ~1.0 m  
so all water quality measurements averaged at 0.5m

# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: C63.8 Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR, TE Date: 7/15/07

Shoreline Development Index Value: 1.85 Backwater Size 4.8

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>6.68</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>-</u>	<u>-</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>30.93</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1200</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>7.89</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>1.812</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>32.1</u>	<u>5</u>

WATER QUALITY SCORE: **38**

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>27.3</u>	<u>5</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>13.0</u>	<u>5</u>

SPAWNING HABITAT SCORE: **10**

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.



# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: 63.8

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>0.9</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>4.4</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>P</u>	<u>5</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 10

<u>BIO-INDICATORS:</u>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 63

## Additional Notes:

Evidence of water exchange: None observed

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

many standing tree trunks

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: A63.7 Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR, RR, TS Date: 8/15/17

Shoreline Development Index Value: 2.16 Backwater Size 17.4

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>8.00</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>31.88</u>	<u>1</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1368</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>8.07</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>1,585</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>0</u>	<u>5</u>

WATER QUALITY SCORE: 36

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>30.2</u>	<u>5</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>12.3</u>	<u>5</u>

SPAWNING HABITAT SCORE: 10

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: 463.7

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>1.3</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>10.3</u>	<u>5</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>11</u>	<u>1</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 8

<b><u>BIO-INDICATORS:</u></b>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 59

## Additional Notes:

Evidence of water exchange: direct connection via large channel

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

few standing trees

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: C62.9 Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR & TE Date: 7/13/07 - 7/16/07

Shoreline Development Index Value: 2.95 Backwater Size 35.2

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>6.06</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>29.73</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1419</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>7.81</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>2.572</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>41.3</u>	<u>5</u>

WATER QUALITY SCORE: **38**

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>8.5</u>	<u>5</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>21.5</u>	<u>5</u>

SPAWNING HABITAT SCORE: **10**

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.



# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: 062.9

## COVER:

Vegetation	(1) 10-60% (pond's area)	5	<u>69.4</u>	<u>1</u>
	(2) <10%	1		
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5	<u>6.0</u>	<u>3</u>
	(2) 0-10; 101-150	3		
	(3) >150	1		
Rip-Rap	(1) Present	5	<u>A</u>	<u>1</u>
	(2) Absent	1		
Depth >10feet	(1) 15-35% (of pond)	5	<u>0</u>	<u>1</u>
	(2) >35%	3		
	(3) <15%	1		

COVER SCORE: 6

## BIO-INDICATORS:

- |  |   |
|--|---|
| (1) Fish present (except Gambusia or bullhead) | 5 |
| (2) Fish absent                                | 1 |

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 59

## Additional Notes:

Evidence of water exchange: No obvious surface connection to river

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

many standing tree trunks, lots of undercut bank

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: A62.3 Location/Reach: 5

Channel Formation Type: \_\_\_\_\_

Backwater Type (circle one): Connected Isolated

Observer(s): MR,RR Date: 6/24/07

Shoreline Development Index Value: 1.64 Backwater Size 11.2

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>8.0</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>29.0</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1344</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>8.9</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>6.756</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>5.3</u>	<u>5</u>

WATER QUALITY SCORE: 38

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>9.0</u>	<u>5</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>44.6</u>	<u>5</u>

SPAWNING HABITAT SCORE: 10

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: A62.3

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>50.0</u>	<u>5</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>110.3</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>0</u>	<u>5</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>26.2</u>	<u>5</u>
	(3) <15%	1		

COVER SCORE: 18

<b><u>BIO-INDICATORS:</u></b>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 71

## Additional Notes:

Evidence of water exchange: large channel to river

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

few standing tree trunks

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: A59.7 Location/Reach: 5

Channel Formation Type: dredged channel and floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): TS, TE Date: 8/12/07

Shoreline Development Index Value: 5.23 Backwater Size 10.2

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>7.28</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>-</u>	<u>-</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>30.39</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1350</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>8.01</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>40.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>2.41</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>7.2</u>	<u>5</u>

WATER QUALITY SCORE: **38**

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>61.7</u>	<u>1</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>2.7</u>	<u>1</u>

SPAWNING HABITAT SCORE: **2**

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.



# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: 459.7

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>17.7</u>	<u>5</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>6.18</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>A</u>	<u>1</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 10

<u>BIO-INDICATORS:</u>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 55

## Additional Notes:

Evidence of water exchange: large, direct channel to river

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

Nothing unique relative to other sites, except for overall shape

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: C57.6a Location/Reach: 5

Channel Formation Type: floodplain depression; possibly along former river channel

Backwater Type (circle one): Connected Isolated

Observer(s): TE, MR Date: 6/24/07

Shoreline Development Index Value: 3.87 Backwater Size 28.5

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>5.2</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>27.4</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1960</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>9.6</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>10.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>3.874</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>10.3</u>	<u>5</u>

WATER QUALITY SCORE: 38

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>81.5</u>	<u>1</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>22.7</u>	<u>5</u>

SPAWNING HABITAT SCORE: 6

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: C 57.6 a

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>81.5</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>111.7</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>A</u>	<u>1</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0.1</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 6

<u>BIO-INDICATORS:</u>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 55

## Additional Notes:

Evidence of water exchange: direct connection to river

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

\_\_\_\_\_

Other observations:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: 657.6 Location/Reach: 5

Channel Formation Type: flood plain depressions (3 pools)

Backwater Type (circle one): Connected Isolated

Observer(s): MR TS Date: 7/24/07

Shoreline Development Index Value: 4.37 Backwater Size 16.4

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>0.72</u>	<u>1</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>27.60</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>3550</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>7.26</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>64.71</u>	<u>1</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>82.12</u>	<u>1</u>

WATER QUALITY SCORE: 21

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>79.7</u>	<u>1</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>0</u>	<u>1</u>

SPAWNING HABITAT SCORE: 2

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.



# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: C57.6

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>&lt;10</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>91.32</u>	<u>5</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>A</u>	<u>1</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 8

<u>BIO-INDICATORS:</u>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 36

## Additional Notes:

Evidence of water exchange: None, but water edge extends far into "marsh" area

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

Extensive marsh, not many standing tree trunks compared to other sites

Other observations:

Total depth at Hydrolab sites ~1.0m so all water quality  
measurements averaged at 0.5m. Selenium, chlorophyll a, and  
Cyano bacteria was averaged among all 3 pools

# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: A55.4 Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): CU, NL, RR Date: 7/24/07

Shoreline Development Index Value: 2.16 Backwater Size 14.5

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>4.63</u>	<u>5</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>-</u>	<u>-</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>29.74</u>	<u>3</u>
Salinity	(1) <5,000 ( $\mu$ S/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1425</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>7.56</u>	<u>5</u>
Selenium	(1) <2 $\mu$ g/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 ( $\mu$ g/L)	5		
	(2) >50	1	<u>1.28</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>0</u>	<u>5</u>

WATER QUALITY SCORE: 33

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>100</u>	<u>1</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>0.3</u>	<u>1</u>

SPAWNING HABITAT SCORE: 2

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: A55.4

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>&lt;10</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>38.3</u>	<u>5</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>A</u>	<u>1</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 8

<u>BIO-INDICATORS:</u>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 48

## Additional Notes:

Evidence of water exchange: \_\_\_\_\_

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

Numerous duck blinds

Other observations:

Total depth at HydroLab sites ~ 1.0m so all water quality measurements  
averaged at 0.5m

# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: A54.3 Location/Reach: 5

Channel Formation Type: Floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR, RR Date: 6/19/07 - 6/20/07

Shoreline Development Index Value: 1.56 Backwater Size 4.9

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>6.5</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>26.9</u>	<u>5</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1245</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>8.00</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>0.767</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>6.2</u>	<u>5</u>

WATER QUALITY SCORE: **40**

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>62.7</u>	<u>1</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>7.5</u>	<u>5</u>

SPAWNING HABITAT SCORE: **6**

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: A54.3

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>&lt;60</u>	<u>5</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>110.9</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>A</u>	<u>1</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 10

## BIO-INDICATORS:

- |  |   |
|--|---|
| (1) Fish present (except Gambusia or bullhead) | 5 |
| (2) Fish absent                                | 1 |

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 61

## Additional Notes:

Evidence of water exchange: direct connection to river (deep channel)

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

lots of floating vegetation and undercut banks

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: C53.5 Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR, ML Date: 8/14/07

Shoreline Development Index Value: 1.34 Backwater Size 5.6

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>7.76</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>-</u>	<u>-</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>30.0</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1316</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>8.03</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>0.684</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>8.3</u>	<u>5</u>

WATER QUALITY SCORE: **38**

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>15.2</u>	<u>5</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>13.2</u>	<u>5</u>

SPAWNING HABITAT SCORE: **10**

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: 053.5

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>47.8</u>	<u>5</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>5.3</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>11</u>	<u>1</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 16

<u>BIO-INDICATORS:</u>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 63

## Additional Notes:

Evidence of water exchange: 2 direct channels to river

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

few standing tree trunks

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: A53.4 Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR, RR Date: 6/19/07 - 6/20/07

Shoreline Development Index Value: 2.54 Backwater Size 5.2

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>7.56</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>27.42</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1228</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>8.90</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>0.695</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>0</u>	<u>5</u>

WATER QUALITY SCORE: **38**

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>19.4</u>	<u>5</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>22.0</u>	<u>5</u>

SPAWNING HABITAT SCORE: **10**

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: A53.4

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>32.9</u>	<u>5</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>108.9</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>P</u>	<u>5</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 14

<u>BIO-INDICATORS:</u>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 67

## Additional Notes:

Evidence of water exchange: deep channel connects to river

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

standing trees

Other observations:

difficult to access (overgrown channel) so probably not used  
for recreation in some time

# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: C52, 5 Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): TE, MR Date: 6/21/07

Shoreline Development Index Value: 2.05 Backwater Size 7.1

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>7.6</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>26.8</u>	<u>5</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1276</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>8.7</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>2.477</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>14.1</u>	<u>5</u>

WATER QUALITY SCORE: 40

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>28.5</u>	<u>5</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>8.3</u>	<u>5</u>

SPAWNING HABITAT SCORE: 10

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.



# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: C 52.5

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>47.6</u>	<u>5</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>1,3</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>P</u>	<u>5</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>1.4</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 14

<u>BIO-INDICATORS:</u>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 69

## Additional Notes:

Evidence of water exchange: 2 large channels to river

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

standing tree trunks

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: AS1.4 Location/Reach: 5

Channel Formation Type: flood plain depression

Backwater Type (circle one): Connected Isolated

Observer(s): HR, RR, CU, NL Date: 6/16/07 - 6/17/07

Shoreline Development Index Value: 2.45 Backwater Size 10.8

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>10.67</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>27.90</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1255</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>8.53</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>40.025</u>	<u>1</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>1.875</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>22.0</u>	<u>5</u>

WATER QUALITY SCORE: 34

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>22.1</u>	<u>5</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>10.9</u>	<u>5</u>

SPAWNING HABITAT SCORE: 10

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: AS1.4

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>70.5</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>108.8</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>P</u>	<u>5</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>27.2</u>	<u>5</u>
	(3) <15%	1		

COVER SCORE:

14

## BIO-INDICATORS:

- |  |   |
|--|---|
| (1) Fish present (except Gambusia or bullhead) | 5 |
| (2) Fish absent                                | 1 |

BIO-INDICATORS SCORE:

5

TOTAL SCORE (sum of all items):

63

## Additional Notes:

Evidence of water exchange: direct connection to river via dredge channel

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

many standing tree trunks

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: 149.2 Location/Reach: 5

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR, CU, NC Date: 6/15/07

Shoreline Development Index Value: 1.73 Backwater Size 10.1

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>7.83</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>29.60</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>2364</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>8.21</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>0.896</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>10.2</u>	<u>5</u>

WATER QUALITY SCORE: **38**

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>28.9</u>	<u>5</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>8.5</u>	<u>5</u>

SPAWNING HABITAT SCORE: **10**

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: 149.2

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>&lt;10%</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>1.84</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>P</u>	<u>5</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>5.2</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 10

<b><u>BIO-INDICATORS:</u></b>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 63

## Additional Notes:

Evidence of water exchange: Currently has no apparent surface connection (channel is silted in)

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

large area<sup>in lake</sup> with trees; standing tree trunks

Other observations:

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# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: 648.5 Location/Reach: 6

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): TS, TE Date: 8/13/07

Shoreline Development Index Value: 2.28 Backwater Size 50.2

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>4.89</u>	<u>5</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>30.55</u>	<u>3</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>2137</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>7.82</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>0.670</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>35.7</u>	<u>5</u>

WATER QUALITY SCORE: 33

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>96.6</u>	<u>1</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>15.5</u>	<u>5</u>

SPAWNING HABITAT SCORE: 6

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: C48.5

## COVER:

Vegetation	(1) 10-60% (pond's area)	5	<u>91.2</u>	<u>1</u>
	(2) <10%	1		
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5	<u>2.57</u>	<u>3</u>
	(2) 0-10; 101-150	3		
	(3) >150	1		
Rip-Rap	(1) Present	5	<u>A</u>	<u>1</u>
	(2) Absent	1		
Depth >10feet	(1) 15-35% (of pond)	5	<u>0</u>	<u>1</u>
	(2) >35%	3		
	(3) <15%	1		

COVER SCORE: 6

<b><u>BIO-INDICATORS:</u></b>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 50

## **Additional Notes:**

Evidence of water exchange: Small channel from dam? no flow apparent during survey

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

Large rock piles (4) in center of lake with rebar around them

Other observations:

Very dense submergent vegetation; temperature much higher in these areas than the open water where hydrologic profiles recorded

# Biological Suitability Criteria Worksheet

Page 1 of 2

Backwater Number: C4B.2 Location/Reach: 6

Channel Formation Type: floodplain depression

Backwater Type (circle one): Connected Isolated

Observer(s): MR, MC Date: 8/12/07

Shoreline Development Index Value: 1.98 Backwater Size 4.9

## WATER QUALITY:

			<u>Measured Value</u>	<u>Score</u>
Hypolimnetic	(1) >5 (mg/L)	10		
Dissolved Oxygen	(2) 3.0-5	5		
	(3) <3.0	1	<u>8.01</u>	<u>10</u>
Epilimnetic	(1) >3.5 (mg/L)	5		
Dissolved Oxygen *	(2) <3.5	1	<u>—</u>	<u>—</u>
Temperature	(1) <27 (degrees Celsius)	5		
	(2) 27-31	3		
	(3) >31	1	<u>33.61</u>	<u>1</u>
Salinity	(1) <5,000 (µS/cm)	5		
	(2) 5,000-10,000	3		
	(3) >10,000	1	<u>1903</u>	<u>5</u>
pH	(1) 7-10	5		
	(2) 6-6.99	3		
	(3) <6 or >10	1	<u>7.76</u>	<u>5</u>
Selenium	(1) <2 µg/L	5		
	(2) >2	1	<u>&lt;0.025</u>	<u>5</u>
Chlorophyll a	(1) <50 (µg/L)	5		
	(2) >50	1	<u>0.765</u>	<u>5</u>
Cyanobacteria	(1) <50% composition	5		
	(2) >50% composition	1	<u>33.7</u>	<u>5</u>

WATER QUALITY SCORE: 36

## SPAWNING HABITAT:

Depth <5feet	(1) <50%	5		
	(2) >50%	1	<u>100</u>	<u>1</u>
Gravel Substrate	(1) >5% (pond's perimeter)	5		
	(2) <5%	1	<u>11.6</u>	<u>5</u>

SPAWNING HABITAT SCORE: 6

\* - Epilimnetic DO is only evaluated if Hypolimnetic DO is <3.0; only 1 DO value is used for calculation of a site score.

# Biological Suitability Criteria Worksheet

Page 2 of 2

Backwater Number: C48.2

## COVER:

Vegetation	(1) 10-60% (pond's area)	5		
	(2) <10%	1	<u>&lt;10</u>	<u>1</u>
	(3) >60%	1		
Turbidity	(1) 10-100 (NTU)	5		
	(2) 0-10; 101-150	3	<u>0.4</u>	<u>3</u>
	(3) >150	1		
Rip-Rap	(1) Present	5		
	(2) Absent	1	<u>A</u>	<u>1</u>
Depth >10feet	(1) 15-35% (of pond)	5		
	(2) >35%	3	<u>0</u>	<u>1</u>
	(3) <15%	1		

COVER SCORE: 6

<b><u>BIO-INDICATORS:</u></b>	(1) Fish present (except Gambusia or bullhead)	5
	(2) Fish absent	1

BIO-INDICATORS SCORE: 5

TOTAL SCORE (sum of all items): 53

## Additional Notes:

Evidence of water exchange: none

Unique cover features (beaver dam, standing tree trunks, undercut banks, etc.):

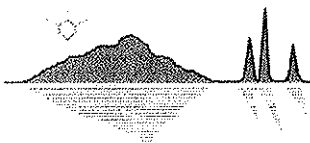
no standing trees

Other observations:

Hot shallow site with silt throughout (except for patches of  
gravel around edges) and little cover

**APPENDIX C: WATER QUALITY GRAB SAMPLE  
RESULTS**





**TRANSWEST  
GEOCHEM**

Date Printed 09-Aug-07

License No. AZM133/AZ0133

CLIENT: Bio-West

Client Sample ID: A67.9B

Work Order: 0707290

Collection Date: 7/10/2007 11:10:00 AM

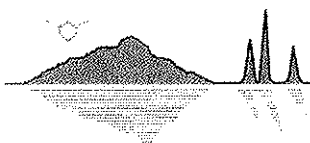
Lab ID: 0707290-03

Matrix: Water

Project Name: 2007 Backwater Site Visits

Project Number:

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	110	25	D2	mg/L	10	EPA300	N/A	7/24/07	TL	IC-7/24/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	7/18/07	TL	IC-7/18/2007
Sulfate	320	30	D2	mg/L	10	EPA300	N/A	7/24/07	TL	IC-7/24/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	7/23/07	TL	NO3_W-7/23/2007C
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	N/A	7/14/07	BAB	P-TOTAL-7/16/2007
Spec. Conductance @25 C	1100	1.0		µmhos/cm	1.0	SM 2510 B	N/A	7/27/07	TL	CONDUCT-7/27/2007
Total Dissolved Solids	750	20	D2	mg/L	2.0	SM 2540 C	N/A	7/12/07	MFB	TDS_DW-7/17/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	7/13/07	MFB	TSS_W-7/14/2007
Alkalinity, Bicarbonate (As Ca)	150	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Alkalinity, Total (As CaCO3)	160	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Organic Carbon, Total	3.2	1.0		mg/L	1.0	SM5310C	N/A	7/25/07	MDD	TOC_W-7/25/2007A
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:14	BJK	14129
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:14	BJK	14129
Barium	0.16	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:14	BJK	14129
Boron	0.17	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:14	BJK	14129
Calcium	92	1.0		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:14	BJK	14129
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:14	BJK	14129
Magnesium	35	1.0		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:14	BJK	14129
Manganese	0.029	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:14	BJK	14129
Potassium	8.2	2.0		mg/L	1.0	EPA200.7	7/13/07	7/19/07 13:01	BJK	14129
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:14	BJK	14129
Silica	10	0.43		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:14	BJK	14129
Sodium	110	20	D2	mg/L	10	EPA200.7	7/13/07	7/19/07 14:10	BJK	14129
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	7/16/07	7/16/07	LB	14146

**TRANSWEST  
GEOCHEM**

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CLIENT: Bio-West

Work Order: 0707290

Lab ID: 0707290-04

Project Name: 2007 Backwater Site Visits

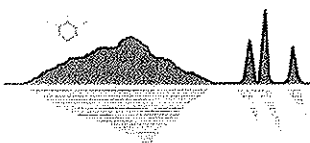
Project Number:

Client Sample ID: A69.7C

Collection Date: 7/8/2007 11:30:00 AM

Matrix: Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	120	25	D2	mg/L	10	EPA300	N/A	7/24/07	TL	IC-7/24/2007
Fluoride	0.51	0.50		mg/L	1.0	EPA300	N/A	7/18/07	TL	IC-7/18/2007
Sulfate	330	30	D2	mg/L	10	EPA300	N/A	7/24/07	TL	IC-7/24/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	7/23/07	TL	NO3_W-7/23/2007C
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	N/A	7/14/07	BAB	P-TOTAL-7/16/2007
Spec. Conductance @25 C	1100	1.0		µmhos/cm	1.0	SM 2510 B	N/A	7/27/07	TL	CONDUCT-7/27/2007
Total Dissolved Solids	760	20	D2	mg/L	2.0	SM 2540 C	N/A	7/12/07	MFB	TDS_DW-7/17/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	7/13/07	MFB	TSS_W-7/14/2007
Alkalinity, Bicarbonate (As Ca)	140	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Alkalinity, Carbonate (As CaCO <sub>3</sub> )	<20	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Alkalinity, Hydroxide (As CaCO <sub>3</sub> )	<20	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Alkalinity, Total (As CaCO <sub>3</sub> )	140	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Organic Carbon, Total	4.3	1.0		mg/L	1.0	SM5310C	N/A	7/25/07	MDD	TOC_W-7/25/2007A
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:18	BJK	14129
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:18	BJK	14129
Barium	0.068	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:18	BJK	14129
Boron	0.18	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:18	BJK	14129
Calcium	88	1.0		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:18	BJK	14129
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:18	BJK	14129
Magnesium	36	1.0		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:18	BJK	14129
Manganese	0.028	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:18	BJK	14129
Potassium	7.1	2.0		mg/L	1.0	EPA200.7	7/13/07	7/19/07 13:05	BJK	14129
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:18	BJK	14129
Silica	11	0.43		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:18	BJK	14129
Sodium	110	20	D2	mg/L	10	EPA200.7	7/13/07	7/19/07 14:14	BJK	14129
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	7/16/07	7/16/07	LB	14148



**TRANSWEST  
GEOCHEM**

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CLIENT: Bio-West

Client Sample ID: A-67.9

Work Order: 0707290

Collection Date: 7/9/2007 12:20:00 PM

Lab ID: 0707290-02

Matrix: Water

Project Name: 2007 Backwater Site Visits

Project Number:

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	110	25	D2	mg/L	10	EPA300	N/A	7/24/07	TL	IC-7/24/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	7/18/07	TL	IC-7/18/2007
Sulfate	310	30	D2	mg/L	10	EPA300	N/A	7/24/07	TL	IC-7/24/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	7/23/07	TL	NO3_W-7/23/2007C
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	N/A	7/14/07	BAB	P-TOTAL-7/16/2007
Spec. Conductance @25 C	1100	1.0		µmhos/cm	1.0	SM 2510 B	N/A	7/27/07	TL	CONDUCT-7/27/2007
Total Dissolved Solids	740	20	D2	mg/L	2.0	SM 2540 C	N/A	7/12/07	MFB	TDS_DW-7/17/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	7/13/07	MFB	TSS_W-7/14/2007
Alkalinity, Bicarbonate (As Ca)	150	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Alkalinity, Total (As CaCO3)	160	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Organic Carbon, Total	3.1	1.0		mg/L	1.0	SM5310C	N/A	7/25/07	MDD	TOC_W-7/25/2007A
Aluminum	0.11	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:11	BJK	14129
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:11	BJK	14129
Barium	0.16	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:11	BJK	14129
Boron	0.17	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:11	BJK	14129
Calcium	91	1.0		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:11	BJK	14129
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:11	BJK	14129
Magnesium	34	1.0		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:11	BJK	14129
Manganese	0.030	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:11	BJK	14129
Potassium	7.7	2.0		mg/L	1.0	EPA200.7	7/13/07	7/19/07 12:57	BJK	14129
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:11	BJK	14129
Silica	9.7	0.43		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:11	BJK	14129
Sodium	110	20	D2	mg/L	10	EPA200.7	7/13/07	7/19/07 14:07	BJK	14129
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	7/16/07	7/16/07	LB	14148



**TRANSWEST  
GEOCHEM**

Date Printed 23-Aug-07

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CLIENT: Bio-West  
Work Order: 0707744  
Lab ID: 0707744-01  
Project Name:  
Project Number:

Client Sample ID: C67.6a  
Collection Date: 7/28/2007 2:00:00 PM  
Matrix: Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	97	25	D2	mg/L	10	EPA300	N/A	8/10/07	TL	IC-8/10/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	8/13/07	TL	IC-8/13/2007
Sulfate	250	30	D2	mg/L	10	EPA300	N/A	8/10/07	TL	IC-8/10/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/14/07	TL	NO3_W-8/14/2007B
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	N/A	8/11/07	BAB	P-TOTAL-8/11/2007
Spec. Conductance @25 C	1100	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/10/07	SO	CONDUCT-8/10/2007
Total Dissolved Solids	740	20	D2	mg/L	2.0	SM 2540 C	N/A	8/3/07	MAG	TDS_DW-8/9/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/1/07	MFB	TSS_W-8/2/2007
Alkalinity, Bicarbonate (As Ca)	160	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Total (As CaCO3)	160	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Organic Carbon, Total	4.2	1.0		mg/L	1.0	SM5310C	N/A	8/3/07	MDD	TOC_W-8/2/2007B
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:35	BJK	14330
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:35	BJK	14330
Barium	0.17	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:35	BJK	14330
Boron	0.18	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:35	BJK	14330
Calcium	94	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:35	BJK	14330
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:35	BJK	14330
Magnesium	36	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:35	BJK	14330
Manganese	0.097	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:35	BJK	14330
Potassium	9.2	2.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:35	BJK	14330
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:35	BJK	14330
Silica	10	0.43		mg/L	1.0	EPA200.7	8/6/07	8/9/07 12:05	BJK	14330
Sodium	120	20	D2	mg/L	10	EPA200.7	8/6/07	8/9/07 12:16	BJK	14330
Mercury	0.0008	0.0002		mg/L	1.0	EPA245.1	8/6/07	8/6/07	LB	14323

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Date Printed 23-Aug-07

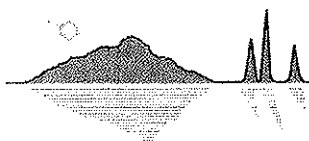
License No. AZM133/AZ0133

**CLIENT:** Bio-West  
**Work Order:** 0707744  
**Lab ID:** 0707744-02  
**Project Name:**  
**Project Number:**

**Client Sample ID:** C67.6b  
**Collection Date:** 7/27/2007 12:30:00 PM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
<b>Chloride</b>	<b>95</b>	25	D2	mg/L	10	EPA300	N/A	8/10/07	TL	IC-8/10/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	8/10/07	TL	IC-8/10/2007
<b>Sulfate</b>	<b>260</b>	30	D2	mg/L	10	EPA300	N/A	8/10/07	TL	IC-8/10/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/14/07	TL	NO3_W-8/14/2007B
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	N/A	8/11/07	BAB	P-TOTAL-8/11/2007
<b>Spec. Conductance @25 C</b>	<b>990</b>	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/10/07	SO	CONDUCT-8/10/2007
<b>Total Dissolved Solids</b>	<b>670</b>	20	D2	mg/L	2.0	SM 2540 C	N/A	8/3/07	MAG	TDS_DW-8/9/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/1/07	MFB	TSS_W-8/2/2007
<b>Alkalinity, Bicarbonate (As Ca)</b>	<b>78</b>	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Carbonate (As CaCO <sub>3</sub> )	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Hydroxide (As CaCO <sub>3</sub> )	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
<b>Alkalinity, Total (As CaCO<sub>3</sub>)</b>	<b>86</b>	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
<b>Organic Carbon, Total</b>	<b>3.5</b>	1.0		mg/L	1.0	SM5310C	N/A	8/8/07	MDD	TOC_W-8/8/2007
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:39	BJK	14330
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:39	BJK	14330
<b>Barium</b>	<b>0.13</b>	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:39	BJK	14330
<b>Boron</b>	<b>0.17</b>	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:39	BJK	14330
<b>Calcium</b>	<b>63</b>	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:39	BJK	14330
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:39	BJK	14330
<b>Magnesium</b>	<b>34</b>	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:39	BJK	14330
<b>Manganese</b>	<b>0.014</b>	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:39	BJK	14330
<b>Potassium</b>	<b>4.2</b>	2.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:39	BJK	14330
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:39	BJK	14330
<b>Silica</b>	<b>8.7</b>	0.43		mg/L	1.0	EPA200.7	8/6/07	8/9/07 12:09	BJK	14330
<b>Sodium</b>	<b>110</b>	20	D2	mg/L	10	EPA200.7	8/6/07	8/9/07 12:20	BJK	14330
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/6/07	8/6/07	LB	14323



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CLIENT: Bio-West

Work Order: 0707290

Lab ID: 0707290-01

Project Name: 2007 Backwater Site Visits

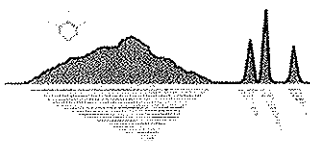
Project Number:

Client Sample ID: A67.5

Collection Date: 7/7/2007 11:30:00 AM

Matrix: Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	100	25	D2	mg/L	10	EPA300	N/A	7/18/07	TL	IC-7/18/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	7/18/07	TL	IC-7/18/2007
Sulfate	290	30	D2	mg/L	10	EPA300	N/A	7/18/07	TL	IC-7/18/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	7/23/07	TL	NO3_W-7/23/2007C
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	N/A	7/14/07	BAB	P-TOTAL-7/16/2007
Spec. Conductance @25 C	1100	1.0		µmhos/cm	1.0	SM 2510 B	N/A	7/27/07	TL	CONDUCT-7/27/2007
Total Dissolved Solids	790	20	D2	mg/L	2.0	SM 2540 C	N/A	7/12/07	MFB	TDS_DW-7/17/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	7/13/07	MFB	TSS_W-7/14/2007
Alkalinity, Bicarbonate (As Ca	160	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Alkalinity, Total (As CaCO3)	160	20		mg/L	1.0	SM2320 B	N/A	7/17/07	TA	ALK_W-7/17/2007
Organic Carbon, Total	3.8	1.0		mg/L	1.0	SM5310C	N/A	7/25/07	MDD	TOC_W-7/25/2007A
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:00	BJK	14129
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:00	BJK	14129
Barium	0.15	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:00	BJK	14129
Boron	0.18	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:00	BJK	14129
Calcium	96	1.0		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:00	BJK	14129
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:00	BJK	14129
Magnesium	37	1.0		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:00	BJK	14129
Manganese	0.040	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:00	BJK	14129
Potassium	8.3	2.0		mg/L	1.0	EPA200.7	7/13/07	7/19/07 12:54	BJK	14129
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:00	BJK	14129
Silica	10	0.43		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:00	BJK	14129
Sodium	120	20	D2	mg/L	10	EPA200.7	7/13/07	7/19/07 14:03	BJK	14129
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	7/16/07	7/16/07	LB	14148

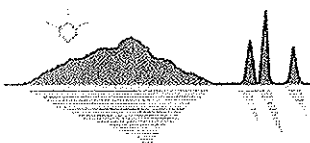
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Date Printed 09-Aug-07

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**CLIENT:** Bio-West**Work Order:** 0707290**Lab ID:** 0707290-05**Project Name:** 2007 Backwater Site Visits**Project Number:****Client Sample ID:** C65.0**Collection Date:** 7/11/2007 12:15:00 PM**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
<b>Chloride</b>	<b>130</b>	25	D2	mg/L	10	EPA300	N/A	7/24/07	TL	IC-7/24/2007
<b>Fluoride</b>	<b>0.51</b>	0.50		mg/L	1.0	EPA300	N/A	7/18/07	TL	IC-7/18/2007
<b>Sulfate</b>	<b>350</b>	30	D2	mg/L	10	EPA300	N/A	7/24/07	TL	IC-7/24/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	7/23/07	TL	NO3_W-7/23/2007C
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	N/A	7/19/07	BAB	P-TOTAL-7/19/2007
<b>Spec. Conductance @25 C</b>	<b>1100</b>	1.0		µmhos/cm	1.0	SM 2510 B	N/A	7/27/07	TL	CONDUCT-7/27/2007
<b>Total Dissolved Solids</b>	<b>790</b>	20	D2	mg/L	2.0	SM 2540 C	N/A	7/12/07	MFB	TDS_DW-7/17/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	7/13/07	MFB	TSS_W-7/14/2007
<b>Alkalinity, Bicarbonate (As Ca)</b>	<b>150</b>	20		mg/L	1.0	SM2320 B	N/A	7/24/07	TA	ALK_W-7/24/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/24/07	TA	ALK_W-7/24/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/24/07	TA	ALK_W-7/24/2007
<b>Alkalinity, Total (As CaCO3)</b>	<b>150</b>	20		mg/L	1.0	SM2320 B	N/A	7/24/07	TA	ALK_W-7/24/2007
<b>Organic Carbon, Total</b>	<b>4.1</b>	1.0		mg/L	1.0	SM5310C	N/A	7/25/07	MDD	TOC_W-7/25/2007A
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:22	BJK	14129
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:22	BJK	14129
<b>Barium</b>	<b>0.15</b>	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:22	BJK	14129
<b>Boron</b>	<b>0.18</b>	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:22	BJK	14129
<b>Calcium</b>	<b>90</b>	1.0		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:22	BJK	14129
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:22	BJK	14129
<b>Magnesium</b>	<b>37</b>	1.0		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:22	BJK	14129
<b>Manganese</b>	<b>0.054</b>	0.010		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:22	BJK	14129
<b>Potassium</b>	<b>7.4</b>	2.0		mg/L	1.0	EPA200.7	7/13/07	7/19/07 13:08	BJK	14129
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:22	BJK	14129
<b>Silica</b>	<b>11</b>	0.43		mg/L	1.0	EPA200.7	7/13/07	7/18/07 15:22	BJK	14129
<b>Sodium</b>	<b>120</b>	20	D2	mg/L	10	EPA200.7	7/13/07	7/19/07 14:18	BJK	14129
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	7/16/07	7/16/07	LB	14148



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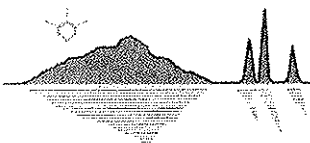
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**CLIENT:** Bio-West  
**Work Order:** 0708597  
**Lab ID:** 0708597-01  
**Project Name:**  
**Project Number:**

**Client Sample ID:** A64.5  
**Collection Date:** 8/11/2007 1:00:00 PM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
<b>Chloride</b>	<b>110</b>	25	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	8/24/07	TL	IC-8/24/2007
<b>Sulfate</b>	<b>280</b>	30	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Nitrogen, Ammonia (As N)	<0.20	0.20		mg/L	1.0	EPA350.1	N/A	8/22/07	ZDP	NH4_W-8/22/2007B
<b>Nitrogen, Kjeldahl, Total</b>	<b>0.71</b>	0.50		mg/L	1.0	EPA351.2	N/A	8/20/07	ZDP	TKN_W-8/20/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/22/07	TL	NO3_W-8/22/2007B
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	8/25/07	8/25/07	HB	P-TOTAL-8/25/2007
<b>Spec. Conductance @25 C</b>	<b>1200</b>	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/24/07	SO	CONDUCT-8/24/2007
<b>Total Dissolved Solids</b>	<b>790</b>	20	D2	mg/L	2.0	SM 2540 C	N/A	8/17/07	MAG	TDS_DW-8/21/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/17/07	MFB	TSS_W-8/19/2007
<b>Alkalinity, Bicarbonate (As Ca</b>	<b>160</b>	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
<b>Alkalinity, Total (As CaCO3)</b>	<b>160</b>	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
<b>Organic Carbon, Total</b>	<b>5.1</b>	5.0	D1	mg/L	5.0	SM5310C	N/A	8/28/07	MDD	TOC_W-8/28/2007A
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	8/21/07	8/22/07 12:04	BJK	14473
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:13	BJK	14473
<b>Barium</b>	<b>0.18</b>	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:13	BJK	14473
<b>Boron</b>	<b>0.19</b>	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:13	BJK	14473
<b>Calcium</b>	<b>99</b>	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:13	BJK	14473
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:13	BJK	14473
<b>Magnesium</b>	<b>39</b>	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:13	BJK	14473
<b>Manganese</b>	<b>0.21</b>	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:13	BJK	14473
<b>Potassium</b>	<b>13</b>	2.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:13	BJK	14473
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:13	BJK	14473
<b>Silica</b>	<b>10</b>	0.43		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:13	BJK	14473
<b>Sodium</b>	<b>120</b>	20	D2	mg/L	10	EPA200.7	8/21/07	8/22/07 11:53	BJK	14473
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/20/07	8/21/07	LB	14469



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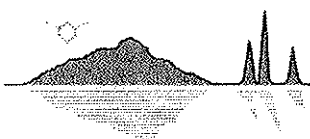
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**CLIENT:** Bio-West  
**Work Order:** 0708597  
**Lab ID:** 0708597-03  
**Project Name:**  
**Project Number:**

**Client Sample ID:** C64.4  
**Collection Date:** 8/10/2007 11:16:00 AM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
<b>Chloride</b>	<b>110</b>	25	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	8/24/07	TL	IC-8/24/2007
<b>Sulfate</b>	<b>280</b>	30	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Nitrogen, Ammonia (As N)	<0.20	0.20		mg/L	1.0	EPA350.1	N/A	8/22/07	ZDP	NH4_W-8/22/2007B
<b>Nitrogen, Kjeldahl, Total</b>	<b>0.55</b>	0.50		mg/L	1.0	EPA351.2	N/A	8/24/07	ZDP	TKN_W-8/24/2007A
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/22/07	TL	NO3_W-8/22/2007D
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	8/25/07	8/25/07	HB	P-TOTAL-8/25/2007
<b>Spec. Conductance @25 C</b>	<b>1200</b>	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/24/07	SO	CONDUCT-8/24/2007
<b>Total Dissolved Solids</b>	<b>790</b>	20	D2	mg/L	2.0	SM 2540 C	N/A	8/17/07	MAG	TDS_DW-8/21/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/17/07	MFB	TSS_W-8/19/2007
<b>Alkalinity, Bicarbonate (As Ca</b>	<b>160</b>	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
<b>Alkalinity, Total (As CaCO3)</b>	<b>160</b>	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
<b>Organic Carbon, Total</b>	<b>3.8</b>	1.0		mg/L	1.0	SM5310C	N/A	8/29/07	MDD	TOC2_W-8/29/2007
<b>Aluminum</b>	<b>0.10</b>	0.10		mg/L	1.0	EPA200.7	8/21/07	8/22/07 12:44	BJK	14473
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:28	BJK	14473
<b>Barium</b>	<b>0.18</b>	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:28	BJK	14473
<b>Boron</b>	<b>0.18</b>	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:28	BJK	14473
<b>Calcium</b>	<b>94</b>	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:28	BJK	14473
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:28	BJK	14473
<b>Magnesium</b>	<b>37</b>	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:28	BJK	14473
<b>Manganese</b>	<b>0.076</b>	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:28	BJK	14473
<b>Potassium</b>	<b>8.2</b>	2.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:28	BJK	14473
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:28	BJK	14473
<b>Silica</b>	<b>12</b>	0.43		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:28	BJK	14473
<b>Sodium</b>	<b>130</b>	20	D2	mg/L	10	EPA200.7	8/21/07	8/22/07 12:18	BJK	14473
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/20/07	8/21/07	LB	14469



**TRANSWEST  
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**CLIENT:** Bio-West  
**Work Order:** 0707744  
**Lab ID:** 0707744-03  
**Project Name:**  
**Project Number:**

**Client Sample ID:** C64.1  
**Collection Date:** 7/29/2007 12:30:00 PM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
<b>Chloride</b>	<b>110</b>	25	D2	mg/L	10	EPA300	N/A	8/10/07	TL	IC-8/10/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	8/10/07	TL	IC-8/10/2007
<b>Sulfate</b>	<b>300</b>	30	D2	mg/L	10	EPA300	N/A	8/10/07	TL	IC-8/10/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/14/07	TL	NO3_W-8/14/2007B
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	N/A	8/11/07	BAB	P-TOTAL-8/11/2007
<b>Spec. Conductance @25 C</b>	<b>1200</b>	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/10/07	SO	CONDUCT-8/10/2007
<b>Total Dissolved Solids</b>	<b>820</b>	20	D2	mg/L	2.0	SM 2540 C	N/A	8/3/07	MAG	TDS_DW-8/9/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/1/07	MFB	TSS_W-8/2/2007
<b>Alkalinity, Bicarbonate (As Ca)</b>	<b>160</b>	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Carbonate (As CaCO <sub>3</sub> )	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Hydroxide (As CaCO <sub>3</sub> )	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
<b>Alkalinity, Total (As CaCO<sub>3</sub>)</b>	<b>160</b>	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
<b>Organic Carbon, Total</b>	<b>5.1</b>	1.0		mg/L	1.0	SM5310C	N/A	8/3/07	MDD	TOC_W-8/2/2007B
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:42	BJK	14330
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:42	BJK	14330
<b>Barium</b>	<b>0.18</b>	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:42	BJK	14330
<b>Boron</b>	<b>0.20</b>	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:42	BJK	14330
<b>Calcium</b>	<b>100</b>	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:42	BJK	14330
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:42	BJK	14330
<b>Magnesium</b>	<b>41</b>	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:42	BJK	14330
<b>Manganese</b>	<b>0.036</b>	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:42	BJK	14330
<b>Potassium</b>	<b>10</b>	2.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:42	BJK	14330
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/6/07	8/7/07 17:42	BJK	14330
<b>Silica</b>	<b>12</b>	0.43		mg/L	1.0	EPA200.7	8/6/07	8/9/07 12:13	BJK	14330
<b>Sodium</b>	<b>120</b>	20	D2	mg/L	10	EPA200.7	8/6/07	8/9/07 12:23	BJK	14330
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/6/07	8/6/07	LB	14323





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Date Printed 27-Aug-07

License No. AZM133/AZ0133

**CLIENT:** Bio-West  
**Work Order:** 0707742  
**Lab ID:** 0707742-06  
**Project Name:**  
**Project Number:**

**Client Sample ID:** A63.8  
**Collection Date:** 7/26/2007 12:00:00 PM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	92	25	D2	mg/L	10	EPA300	N/A	8/6/07	TL	IC-8/6/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	8/6/07	TL	IC-8/6/2007
Sulfate	250	30	D2	mg/L	10	EPA300	N/A	8/6/07	TL	IC-8/6/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/10/07	TL	NO3_W-8/10/2007
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	N/A	8/11/07	BAB	P-TOTAL-8/11/2007
Spec. Conductance @25 C	1100	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/10/07	SO	CONDUCT-8/10/2007
Total Dissolved Solids	740	20	D2	mg/L	2.0	SM 2540 C	N/A	7/31/07	MAG	TDS_DW-8/2/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/1/07	MFB	TSS_W-8/2/2007
Alkalinity, Bicarbonate (As Ca)	150	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Total (As CaCO3)	150	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Organic Carbon, Total	4.9	1.0		mg/L	1.0	SM5310C	N/A	8/3/07	MDD	TOC_W-8/2/2007B
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:55	BJK	14329
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:55	BJK	14329
Barium	0.16	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:55	BJK	14329
Boron	0.19	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:55	BJK	14329
Calcium	95	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:55	BJK	14329
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:55	BJK	14329
Magnesium	39	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:55	BJK	14329
Manganese	0.078	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:55	BJK	14329
Potassium	9.3	2.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:55	BJK	14329
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:55	BJK	14329
Silica	10	0.43		mg/L	1.0	EPA200.7	8/6/07	8/9/07 11:29	BJK	14329
Sodium	120	20	D2	mg/L	10	EPA200.7	8/6/07	8/9/07 10:52	BJK	14329
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/6/07	8/6/07	LB	14323



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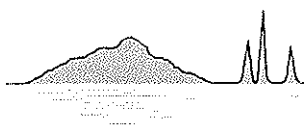
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**CLIENT:** Bio-West  
**Work Order:** 0708598  
**Lab ID:** 0708598-01  
**Project Name:**  
**Project Number:**

**Client Sample ID:** A63.7  
**Collection Date:** 8/15/2007 2:10:00 PM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	110	25	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Sulfate	300	30	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Nitrogen, Ammonia (As N)	<0.20	0.20		mg/L	1.0	EPA350.1	N/A	8/22/07	ZDP	NH4_W-8/22/2007B
Nitrogen, Kjeldahl, Total	0.51	0.50		mg/L	1.0	EPA351.2	N/A	8/24/07	ZDP	TKN_W-8/24/2007A
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	9/6/07	TL	NO3_W-9/6/2007B
Phosphorus, Total (As P)	0.096	0.050		mg/L	1.0	EPA365.3	8/25/07	8/25/07	HB	P-TOTAL-8/25/2007
Spec. Conductance @25 C	1200	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/24/07	SO	CONDUCT-8/24/2007
Total Dissolved Solids	800	20	D2	mg/L	2.0	SM 2540 C	N/A	8/20/07	MAG	TDS_DW-8/22/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/17/07	MFB	TSS_W-8/19/2007
Alkalinity, Bicarbonate (As C	160	20		mg/L	1.0	SM2320 B	N/A	8/29/07	TA	ALK_W-8/29/2007A
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/29/07	TA	ALK_W-8/29/2007A
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/29/07	TA	ALK_W-8/29/2007A
Alkalinity, Total (As CaCO3)	160	20		mg/L	1.0	SM2320 B	N/A	8/29/07	TA	ALK_W-8/29/2007A
Organic Carbon, Total	3.4	1.0		mg/L	1.0	SM5310C	N/A	8/29/07	MDD	TOC2_W-8/29/2007
Aluminum	0.11	0.10		mg/L	1.0	EPA200.7	8/21/07	8/22/07 13:13	BJK	14473
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:49	BJK	14473
Barium	0.16	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:49	BJK	14473
Boron	0.18	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:49	BJK	14473
Calcium	96	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:49	BJK	14473
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:49	BJK	14473
Magnesium	37	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:49	BJK	14473
Manganese	0.040	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:49	BJK	14473
Potassium	8.1	2.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:49	BJK	14473
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:49	BJK	14473
Silica	12	0.43		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:49	BJK	14473
Sodium	130	20	D2	mg/L	10	EPA200.7	8/21/07	8/22/07 13:05	BJK	14473
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/20/07	8/21/07	LB	14469



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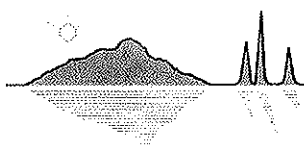
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**CLIENT:** Bio-West  
**Work Order:** 0707742  
**Lab ID:** 0707742-05  
**Project Name:**  
**Project Number:**

**Client Sample ID:** C-62.9  
**Collection Date:** 7/26/2007 11:15:00 AM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	140	25	D2	mg/L	10	EPA300	N/A	8/6/07	TL	IC-8/6/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	8/6/07	TL	IC-8/6/2007
Sulfate	360	30	D2	mg/L	10	EPA300	N/A	8/6/07	TL	IC-8/6/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/10/07	TL	NO3_W-8/10/2007
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	N/A	8/11/07	BAB	P-TOTAL-8/11/2007
Spec. Conductance @25 C	1300	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/10/07	SO	CONDUCT-8/10/2007
Total Dissolved Solids	890	20	D2	mg/L	2.0	SM 2540 C	N/A	7/31/07	MAG	TDS_DW-8/2/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/1/07	MFB	TSS_W-8/2/2007
Alkalinity, Bicarbonate (As Ca	170	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Total (As CaCO3)	170	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Organic Carbon, Total	4.8	1.0		mg/L	1.0	SM5310C	N/A	8/3/07	MDD	TOC_W-8/2/2007B
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:52	BJK	14329
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:52	BJK	14329
Barium	0.14	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:52	BJK	14329
Boron	0.21	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:52	BJK	14329
Calcium	87	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:52	BJK	14329
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:52	BJK	14329
Magnesium	38	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:52	BJK	14329
Manganese	0.095	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:52	BJK	14329
Potassium	8.2	2.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:52	BJK	14329
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:52	BJK	14329
Silica	16	0.43		mg/L	1.0	EPA200.7	8/6/07	8/9/07 11:25	BJK	14329
Sodium	150	20	D2	mg/L	10	EPA200.7	8/6/07	8/9/07 10:49	BJK	14329
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/6/07	8/6/07	LB	14323



**TRANSWEST  
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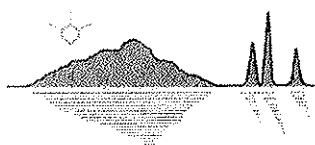
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CLIENT: Bio-West  
Work Order: 0706557  
Lab ID: 0706557-03  
Project Name:  
Project Number:

Client Sample ID: A62.3  
Collection Date: 6/25/2007 12:00:00 PM  
Matrix: Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	110	25	D2	mg/L	10	EPA300	N/A	7/10/07	MDD	IC_070710
Fluoride	0.52	0.50		mg/L	1.0	EPA300	N/A	7/10/07	MDD	IC_070710
Sulfate	320	30	D2	mg/L	10	EPA300	N/A	7/10/07	MDD	IC_070710
Nitrogen, Ammonia (As N)	<0.20	0.20		mg/L	1.0	EPA350.1	N/A	7/11/07	BAB	NH4_W-7/11/2007A
Nitrogen, Kjeldahl, Total	1.3	0.50		mg/L	1.0	EPA351.2	7/3/07	7/5/07	BAB	TKN_W-7/5/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	7/2/07	TL	NO3_W-7/2/2007B
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	N/A	7/14/07	BAB	P-TOTAL-7/16/2007
Spec. Conductance @25 C	1200	1.0		µmhos/cm	1.0	SM 2510 B	N/A	7/3/07	SO	CONDUCT-7/5/2007
Total Dissolved Solids	810	20	D2	mg/L	2.0	SM 2540 C	N/A	6/29/07	MFB	TDS_DW-7/3/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	7/2/07	MFB	TSS_W-7/3/2007
Alkalinity, Bicarbonate (As C	150	20		mg/L	1.0	SM2320 B	N/A	7/5/07	KMB	ALK_W-7/5/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/5/07	KMB	ALK_W-7/5/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/5/07	KMB	ALK_W-7/5/2007
Alkalinity, Total (As CaCO3)	150	20		mg/L	1.0	SM2320 B	N/A	7/5/07	KMB	ALK_W-7/5/2007
Organic Carbon, Total	3.8	1.0		mg/L	1.0	SM5310C	N/A	7/10/07	CS	TOC-7/11/2007
Aluminum	0.11	0.10		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:28	BJK	14068
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:33	BJK	14068
Barium	0.16	0.010		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:28	BJK	14068
Boron	0.18	0.10		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:28	BJK	14068
Calcium	92	1.0		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:33	BJK	14068
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:33	BJK	14068
Magnesium	36	1.0		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:33	BJK	14068
Manganese	0.035	0.010		mg/L	1.0	EPA200.7	7/5/07	7/16/07 10:03	BJK	14068
Potassium	8.1	2.0		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:33	BJK	14068
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:28	BJK	14068
Silica	12	0.43		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:28	BJK	14068
Sodium	120	20	D2	mg/L	10	EPA200.7	7/5/07	7/13/07 16:56	BJK	14068
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	7/5/07	7/5/07	LB	14061



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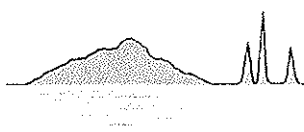
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**CLIENT:** Bio-West  
**Work Order:** 0708597  
**Lab ID:** 0708597-05  
**Project Name:**  
**Project Number:**

**Client Sample ID:** A59.7  
**Collection Date:** 8/12/2007 2:06:00 PM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
<b>Chloride</b>	<b>110</b>	25	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	8/24/07	TL	IC-8/24/2007
<b>Sulfate</b>	<b>280</b>	30	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Nitrogen, Ammonia (As N)	<0.20	0.20		mg/L	1.0	EPA350.1	N/A	8/22/07	ZDP	NH4_W-8/22/2007B
<b>Nitrogen, Kjeldahl, Total</b>	<b>0.53</b>	0.50		mg/L	1.0	EPA351.2	N/A	8/24/07	ZDP	TKN_W-8/24/2007A
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/22/07	TL	NO3_W-8/22/2007B
<b>Phosphorus, Total (As P)</b>	<b>16</b>	1.0	D2	mg/L	20	EPA365.3	8/25/07	8/25/07	HB	P-TOTAL-8/25/2007
<b>Spec. Conductance @25 C</b>	<b>1100</b>	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/24/07	SO	CONDUCT-8/24/2007
<b>Total Dissolved Solids</b>	<b>780</b>	20	D2	mg/L	2.0	SM 2540 C	N/A	8/17/07	MAG	TDS_DW-8/21/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/17/07	MFB	TSS_W-8/19/2007
<b>Alkalinity, Bicarbonate (As Ca</b>	<b>160</b>	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
<b>Alkalinity, Total (As CaCO3)</b>	<b>160</b>	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
<b>Organic Carbon, Total</b>	<b>3.1</b>	1.0		mg/L	1.0	SM5310C	N/A	8/29/07	MDD	TOC2_W-8/29/2007
<b>Aluminum</b>	<b>0.11</b>	0.10		mg/L	1.0	EPA200.7	8/21/07	8/22/07 12:51	BJK	14473
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:35	BJK	14473
<b>Barium</b>	<b>0.17</b>	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:35	BJK	14473
<b>Boron</b>	<b>0.18</b>	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:35	BJK	14473
<b>Calcium</b>	<b>97</b>	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:35	BJK	14473
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:35	BJK	14473
<b>Magnesium</b>	<b>37</b>	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:35	BJK	14473
<b>Manganese</b>	<b>0.027</b>	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:35	BJK	14473
<b>Potassium</b>	<b>8.3</b>	2.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:35	BJK	14473
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:35	BJK	14473
<b>Silica</b>	<b>11</b>	0.43		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:35	BJK	14473
<b>Sodium</b>	<b>120</b>	20	D2	mg/L	10	EPA200.7	8/21/07	8/22/07 12:33	BJK	14473
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/20/07	8/21/07	LB	14469





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Date Printed 18-Sep-07

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**CLIENT:** Bio-West  
**Work Order:** 0708598  
**Lab ID:** 0708598-02  
**Project Name:**  
**Project Number:**

**Client Sample ID:** A59.7 Pool A  
**Collection Date:** 8/12/2007 1:50:00 PM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
<b>Chloride</b>	<b>110</b>	25	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	8/24/07	TL	IC-8/24/2007
<b>Sulfate</b>	<b>280</b>	30	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Nitrogen, Ammonia (As N)	<0.20	0.20		mg/L	1.0	EPA350.1	N/A	8/22/07	ZDP	NH4_W-8/22/2007B
<b>Nitrogen, Kjeldahl, Total</b>	<b>0.51</b>	0.50		mg/L	1.0	EPA351.2	N/A	8/24/07	ZDP	TKN_W-8/24/2007A
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/22/07	TL	NO3_W-8/22/2007D
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	9/1/07	9/1/07	HB	P-TOTAL-9/1/2007
<b>Spec. Conductance @25 C</b>	<b>1100</b>	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/24/07	SO	CONDUCT-8/24/2007
<b>Total Dissolved Solids</b>	<b>760</b>	20	D2	mg/L	2.0	SM 2540 C	N/A	8/17/07	MAG	TDS_DW-8/21/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/17/07	MFB	TSS_W-8/19/2007
<b>Alkalinity, Bicarbonate (As C</b>	<b>180</b>	20	H1	mg/L	1.0	SM2320 B	9/4/07	9/4/07	DF	ALK_W9/4/07
Alkalinity, Carbonate (As CaCO3)	<20	20	H1	mg/L	1.0	SM2320 B	9/4/07	9/4/07	DF	ALK_W9/4/07
Alkalinity, Hydroxide (As CaCO3)	<20	20	H1	mg/L	1.0	SM2320 B	9/4/07	9/4/07	DF	ALK_W9/4/07
<b>Alkalinity, Total (As CaCO3)</b>	<b>180</b>	20	H1	mg/L	1.0	SM2320 B	9/4/07	9/4/07	DF	ALK_W9/4/07
<b>Organic Carbon, Total</b>	<b>3.3</b>	1.0		mg/L	1.0	SM5310C	N/A	8/29/07	MDD	TOC2_W_8/29/2007
<b>Aluminum</b>	<b>0.15</b>	0.10		mg/L	1.0	EPA200.7	8/21/07	8/22/07 13:16	BJK	14473
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:53	BJK	14473
<b>Barium</b>	<b>0.15</b>	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:53	BJK	14473
<b>Boron</b>	<b>0.17</b>	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:53	BJK	14473
<b>Calcium</b>	<b>93</b>	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:53	BJK	14473
<b>Iron</b>	<b>0.12</b>	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:53	BJK	14473
<b>Magnesium</b>	<b>35</b>	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:53	BJK	14473
<b>Manganese</b>	<b>0.044</b>	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:53	BJK	14473
<b>Potassium</b>	<b>8.3</b>	2.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:53	BJK	14473
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:53	BJK	14473
<b>Silica</b>	<b>11</b>	0.43		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:53	BJK	14473
<b>Sodium</b>	<b>120</b>	20	D2	mg/L	10	EPA200.7	8/21/07	8/22/07 13:09	BJK	14473
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/20/07	8/21/07	LB	14469



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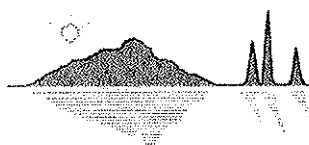
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**CLIENT:** Bio-West  
**Work Order:** 0706557  
**Lab ID:** 0706557-02  
**Project Name:**  
**Project Number:**

**Client Sample ID:** C57.6a  
**Collection Date:** 6/24/2007 11:00:00 AM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	210	25	D2	mg/L	10	EPA300	N/A	7/10/07	MDD	IC_070710
Fluoride	0.62	0.50		mg/L	1.0	EPA300	N/A	7/10/07	MDD	IC_070710
Sulfate	500	30	D2	mg/L	10	EPA300	N/A	7/10/07	MDD	IC_070710
Nitrogen, Ammonia (As N)	<0.20	0.20		mg/L	1.0	EPA350.1	N/A	7/11/07	BAB	NH4_W-7/11/2007A
Nitrogen, Kjeldahl, Total	1.7	0.50		mg/L	1.0	EPA351.2	7/3/07	7/5/07	BAB	TKN_W-7/5/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	7/2/07	TL	NO3_W-7/2/2007a
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	N/A	7/14/07	BAB	P-TOTAL-7/16/2007
Spec. Conductance @25 C	1700	1.0		µmhos/cm	1.0	SM 2510 B	N/A	7/3/07	SO	CONDUCT-7/5/2007
Total Dissolved Solids	1300	40	D2	mg/L	4.0	SM 2540 C	N/A	6/29/07	MFB	TDS_DW-7/3/2007
Total Suspended Solids	<10	10	H1	mg/L	1	SM 2540 D	N/A	7/2/07	MFB	TSS_W-7/3/2007
Alkalinity, Bicarbonate (As C	210	20		mg/L	1.0	SM2320 B	N/A	7/5/07	KMB	ALK_W-7/5/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/5/07	KMB	ALK_W-7/5/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/5/07	KMB	ALK_W-7/5/2007
Alkalinity, Total (As CaCO3)	210	20		mg/L	1.0	SM2320 B	N/A	7/5/07	KMB	ALK_W-7/5/2007
Organic Carbon, Total	9.4	1.0		mg/L	1.0	SM5310C	N/A	7/10/07	CS	TOC-7/11/2007
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:24	BJK	14068
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:29	BJK	14068
Barium	0.17	0.010		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:24	BJK	14068
Boron	0.30	0.10		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:24	BJK	14068
Calcium	130	1.0		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:29	BJK	14068
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:29	BJK	14068
Magnesium	60	1.0		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:29	BJK	14068
Manganese	0.20	0.010		mg/L	1.0	EPA200.7	7/5/07	7/16/07 10:00	BJK	14068
Potassium	15	2.0		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:29	BJK	14068
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:24	BJK	14068
Silica	18	0.43		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:24	BJK	14068
Sodium	220	20	D2	mg/L	10	EPA200.7	7/5/07	7/13/07 16:52	BJK	14068
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	7/5/07	7/5/07	LB	14061



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CLIENT: Bio-West

Client Sample ID: C57.6 pool A

Work Order: 0707742

Collection Date: 7/25/2007 11:15:00 AM

Lab ID: 0707742-01

Matrix: Water

Project Name:

Project Number:

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	320	63	D2	mg/L	25	EPA300	N/A	8/10/07	TL	IC-8/10/2007
Fluoride	0.68	0.50		mg/L	1.0	EPA300	N/A	8/6/07	TL	IC-8/6/2007
Sulfate	640	75	D2	mg/L	25	EPA300	N/A	8/10/07	TL	IC-8/10/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/10/07	TL	NO3_W-8/10/2007
Phosphorus, Total (As P)	0.20	0.050		mg/L	1.0	EPA365.3	N/A	8/9/07	BAB	P-TOTAL-8/9/2007
Spec. Conductance @25 C	2600	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/10/07	SO	CONDUCT-8/10/2007
Total Dissolved Solids	2000	40	D2	mg/L	4.0	SM 2540 C	N/A	7/31/07	MAG	TDS_DW-8/2/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/1/07	MFB	TSS_W-8/2/2007
Alkalinity, Bicarbonate (As Ca)	350	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Total (As CaCO3)	350	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Organic Carbon, Total	26	10	D2	mg/L	10	SM5310C	N/A	8/3/07	MDD	TOC_W_8/3/2007
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:37	BJK	14329
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:37	BJK	14329
Barium	0.15	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:37	BJK	14329
Boron	0.48	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:37	BJK	14329
Calcium	160	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:37	BJK	14329
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:37	BJK	14329
Magnesium	93	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:37	BJK	14329
Manganese	0.34	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:37	BJK	14329
Potassium	27	2.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:37	BJK	14329
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:37	BJK	14329
Silica	32	0.43		mg/L	1.0	EPA200.7	8/6/07	8/9/07 11:10	BJK	14329
Sodium	370	20	D2	mg/L	10	EPA200.7	8/6/07	8/9/07 10:34	BJK	14329
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/6/07	8/6/07	LB	14323



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Date Printed 23-Aug-07

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**CLIENT:** Bio-West  
**Work Order:** 0707742  
**Lab ID:** 0707742-03  
**Project Name:**  
**Project Number:**

**Client Sample ID:** C57.6 pool B  
**Collection Date:** 7/25/2007 4:30:00 PM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
<b>Chloride</b>	<b>260</b>	25	D2	mg/L	10	EPA300	N/A	8/6/07	TL	IC-8/6/2007
<b>Fluoride</b>	<b>0.60</b>	0.50		mg/L	1.0	EPA300	N/A	8/6/07	TL	IC-8/6/2007
<b>Sulfate</b>	<b>570</b>	30	D2	mg/L	10	EPA300	N/A	8/6/07	TL	IC-8/6/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/10/07	TL	NO3_W-8/10/2007
<b>Phosphorus, Total (As P)</b>	<b>0.10</b>	0.050		mg/L	1.0	EPA365.3	N/A	8/11/07	BAB	P-TOTAL-8/11/2007
<b>Spec. Conductance @25 C</b>	<b>2000</b>	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/10/07	SO	CONDUCT-8/10/2007
<b>Total Dissolved Solids</b>	<b>1400</b>	40	D2	mg/L	4.0	SM 2540 C	N/A	7/31/07	MAG	TDS_DW-8/2/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/1/07	MFB	TSS_W-8/2/2007
<b>Alkalinity, Bicarbonate (As Ca)</b>	<b>260</b>	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
<b>Alkalinity, Total (As CaCO3)</b>	<b>260</b>	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
<b>Organic Carbon, Total</b>	<b>17</b>	10	D1	mg/L	10	SM5310C	N/A	8/3/07	MDD	TOC_W-8/3/2007
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:44	BJK	14329
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:44	BJK	14329
<b>Barium</b>	<b>0.15</b>	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:44	BJK	14329
<b>Boron</b>	<b>0.36</b>	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:44	BJK	14329
<b>Calcium</b>	<b>130</b>	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:44	BJK	14329
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:44	BJK	14329
<b>Magnesium</b>	<b>70</b>	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:44	BJK	14329
<b>Manganese</b>	<b>0.31</b>	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:44	BJK	14329
<b>Potassium</b>	<b>18</b>	2.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:44	BJK	14329
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:44	BJK	14329
<b>Silica</b>	<b>25</b>	0.43		mg/L	1.0	EPA200.7	8/6/07	8/9/07 11:18	BJK	14329
<b>Sodium</b>	<b>260</b>	20	D2	mg/L	10	EPA200.7	8/6/07	8/9/07 10:42	BJK	14329
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/6/07	8/6/07	LB	14323

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Date Printed 23-Aug-07

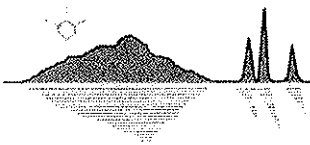
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**CLIENT:** Bio-West  
**Work Order:** 0707742  
**Lab ID:** 0707742-04  
**Project Name:**  
**Project Number:**

**Client Sample ID:** C57.6 pool C  
**Collection Date:** 7/25/2007 3:45:00 PM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
<b>Chloride</b>	<b>280</b>	63	D2	mg/L	25	EPA300	N/A	8/10/07	TL	IC-8/10/2007
<b>Fluoride</b>	<b>0.69</b>	0.50		mg/L	1.0	EPA300	N/A	8/6/07	TL	IC-8/6/2007
<b>Sulfate</b>	<b>600</b>	75	D2	mg/L	25	EPA300	N/A	8/10/07	TL	IC-8/10/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/14/07	TL	NO3_W-8/14/2007B
<b>Phosphorus, Total (As P)</b>	<b>0.15</b>	0.050		mg/L	1.0	EPA365.3	N/A	8/11/07	BAB	P-TOTAL-8/11/2007
<b>Spec. Conductance @25 C</b>	<b>2400</b>	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/10/07	SO	CONDUCT-8/10/2007
<b>Total Dissolved Solids</b>	<b>1800</b>	40	D2	mg/L	4.0	SM 2540 C	N/A	7/31/07	MAG	TDS_DW-8/2/2007
<b>Total Suspended Solids</b>	<b>17</b>	10		mg/L	1	SM 2540 D	N/A	8/1/07	MFB	TSS_W-8/2/2007
<b>Alkalinity, Bicarbonate (As Ca)</b>	<b>350</b>	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
<b>Alkalinity, Total (As CaCO3)</b>	<b>350</b>	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
<b>Organic Carbon, Total</b>	<b>23</b>	10	D2	mg/L	10	SM5310C	N/A	8/3/07	MDD	TOC_W-8/3/2007
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:48	BJK	14329
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:48	BJK	14329
<b>Barium</b>	<b>0.16</b>	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:48	BJK	14329
<b>Boron</b>	<b>0.44</b>	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:48	BJK	14329
<b>Calcium</b>	<b>160</b>	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:48	BJK	14329
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:48	BJK	14329
<b>Magnesium</b>	<b>90</b>	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:48	BJK	14329
<b>Manganese</b>	<b>0.38</b>	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:48	BJK	14329
<b>Potassium</b>	<b>23</b>	2.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:48	BJK	14329
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:48	BJK	14329
<b>Silica</b>	<b>33</b>	0.43		mg/L	1.0	EPA200.7	8/6/07	8/9/07 11:21	BJK	14329
<b>Sodium</b>	<b>330</b>	20	D2	mg/L	10	EPA200.7	8/6/07	8/9/07 10:45	BJK	14329
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/6/07	8/6/07	LB	14323



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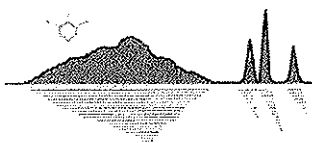
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CLIENT: Bio-West  
Work Order: 0707742  
Lab ID: 0707742-02  
Project Name:  
Project Number:

Client Sample ID: A55.4  
Collection Date: 7/25/2007 1:50:00 PM  
Matrix: Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	120	25	D2	mg/L	10	EPA300	N/A	8/6/07	TL	IC-8/6/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	8/6/07	TL	IC-8/6/2007
Sulfate	300	30	D2	mg/L	10	EPA300	N/A	8/6/07	TL	IC-8/6/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/10/07	TL	NO3_W-8/10/2007
Phosphorus, Total (As P)	0.10	0.050		mg/L	1.0	EPA365.3	N/A	8/9/07	BAB	P-TOTAL-8/9/2007
Spec. Conductance @25 C	1200	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/10/07	SO	CONDUCT-8/10/2007
Total Dissolved Solids	770	20	D2	mg/L	2.0	SM 2540 C	N/A	7/31/07	MAG	TDS_DW-8/2/2007
Total Suspended Solids	13	10		mg/L	1	SM 2540 D	N/A	8/1/07	MFB	TSS_W-8/2/2007
Alkalinity, Bicarbonate (As Ca)	170	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Alkalinity, Total (As CaCO3)	170	20		mg/L	1.0	SM2320 B	N/A	8/3/07	TA	ALK_W-8/3/2007
Organic Carbon, Total	<1.0	1.0		mg/L	1.0	SM5310C	N/A	8/3/07	MDD	TOC_W-8/3/2007
Aluminum	0.60	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:41	BJK	14329
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:41	BJK	14329
Barium	0.20	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:41	BJK	14329
Boron	0.20	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:41	BJK	14329
Calcium	96	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:41	BJK	14329
Iron	0.37	0.10		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:41	BJK	14329
Magnesium	38	1.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:41	BJK	14329
Manganese	0.14	0.010		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:41	BJK	14329
Potassium	12	2.0		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:41	BJK	14329
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/6/07	8/7/07 16:41	BJK	14329
Silica	14	0.43		mg/L	1.0	EPA200.7	8/6/07	8/9/07 11:14	BJK	14329
Sodium	130	20	D2	mg/L	10	EPA200.7	8/6/07	8/9/07 10:38	BJK	14329
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/6/07	8/6/07	LB	14323



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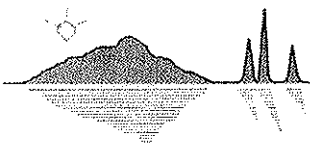
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**CLIENT:** Bio-West  
**Work Order:** 0706405  
**Lab ID:** 0706405-03  
**Project Name:** 2007 Backwater Inventory  
**Project Number:** BW Project #1119

**Client Sample ID:** A54.3  
**Collection Date:** 6/18/2007 11:00:00 AM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
<b>Chloride</b>	<b>110</b>	50	D2	mg/L	20	EPA300	N/A	7/5/07	MDD	IC_070705
<b>Fluoride</b>	<b>0.51</b>	0.50		mg/L	1.0	EPA300	N/A	7/4/07	MDD	IC_070703
<b>Sulfate</b>	<b>280</b>	60	D2	mg/L	20	EPA300	N/A	7/5/07	MDD	IC_070705
Nitrogen, Ammonia (As N)	<0.20	0.20		mg/L	1.0	EPA350.1	N/A	7/11/07	BAB	NH4_W-7/11/2007
<b>Nitrogen, Kjeldahl, Total</b>	<b>1.4</b>	0.50		mg/L	1.0	EPA351.2	7/3/07	7/5/07	BAB	TKN_W-7/5/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	6/29/07	TL	NO3_W-6/29/2007
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	7/7/07	7/7/07	KMB	P-TOTAL-7/9/2007
<b>Spec. Conductance @25 C</b>	<b>1100</b>	1.0		µmhos/cm	1.0	SM 2510 B	N/A	6/27/07	TL	CONDUCT-6/28/2007
<b>Total Dissolved Solids</b>	<b>770</b>	20	D2	mg/L	2.0	SM 2540 C	N/A	6/22/07	MFB	TDS_DW-6/27/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	6/22/07	MFB	TSS_W-6/25/2007
<b>Alkalinity, Bicarbonate (As Ca</b>	<b>140</b>	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
Alkalinity, Carbonate (As CaCO <sub>3</sub> )	<20	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
Alkalinity, Hydroxide (As CaCO <sub>3</sub> )	<20	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
<b>Alkalinity, Total (As CaCO<sub>3</sub>)</b>	<b>140</b>	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
<b>Organic Carbon, Total</b>	<b>3.1</b>	1.0		mg/L	1.0	SM5310C	N/A	7/9/07	CS	TOC-07/09/2007
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:36	TA	13971
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:16	BJK	13971
<b>Barium</b>	<b>0.16</b>	0.010	B1	mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:16	BJK	13971
<b>Boron</b>	<b>0.18</b>	0.10		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:16	BJK	13971
<b>Calcium</b>	<b>90</b>	1.0	B1	mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:16	BJK	13971
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:16	BJK	13971
<b>Magnesium</b>	<b>35</b>	1.0		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:16	BJK	13971
<b>Manganese</b>	<b>0.013</b>	0.010		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:36	TA	13971
<b>Potassium</b>	<b>7.4</b>	2.0	B1	mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:16	BJK	13971
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:36	TA	13971
<b>Silica</b>	<b>8.4</b>	0.43		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:36	TA	13971
<b>Sodium</b>	<b>120</b>	20	D2	mg/L	10	EPA200.7	6/22/07	7/2/07 14:20	TA	13971
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	6/22/07	6/22/07	LB	13967

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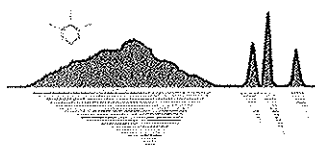
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**CLIENT:** Bio-West  
**Work Order:** 0708597  
**Lab ID:** 0708597-02  
**Project Name:**  
**Project Number:**

**Client Sample ID:** C53.5  
**Collection Date:** 8/14/2007 11:00:00 AM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
<b>Chloride</b>	<b>100</b>	25	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Fluoride	<0.50	0.50		mg/L	1.0	EPA300	N/A	8/24/07	TL	IC-8/24/2007
<b>Sulfate</b>	<b>270</b>	30	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Nitrogen, Ammonia (As N)	<0.20	0.20		mg/L	1.0	EPA350.1	N/A	8/22/07	ZDP	NH4_W-8/22/2007B
Nitrogen, Kjeldahl, Total	<0.50	0.50		mg/L	1.0	EPA351.2	N/A	8/24/07	ZDP	TKN_W-8/24/2007A
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/22/07	TL	NO3_W-8/22/2007D
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	8/25/07	8/25/07	HB	P-TOTAL-8/25/2007
<b>Spec. Conductance @25 C</b>	<b>1100</b>	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/24/07	SO	CONDUCT-8/24/2007
<b>Total Dissolved Solids</b>	<b>740</b>	20	D2	mg/L	2.0	SM 2540 C	N/A	8/17/07	MAG	TDS_DW-8/21/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/17/07	MFB	TSS_W-8/19/2007
<b>Alkalinity, Bicarbonate (As Ca</b>	<b>150</b>	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
<b>Alkalinity, Total (As CaCO3)</b>	<b>150</b>	20		mg/L	1.0	SM2320 B	N/A	8/22/07	DF	ALK_W-8/22/2007
<b>Organic Carbon, Total</b>	<b>2.6</b>	1.0		mg/L	1.0	SM5310C	N/A	8/29/07	MDD	TOC2_W-8/29/2007
<b>Aluminum</b>	<b>0.10</b>	0.10		mg/L	1.0	EPA200.7	8/21/07	8/22/07 12:40	BJK	14473
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:24	BJK	14473
<b>Barium</b>	<b>0.16</b>	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:24	BJK	14473
<b>Boron</b>	<b>0.17</b>	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:24	BJK	14473
<b>Calcium</b>	<b>90</b>	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:24	BJK	14473
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:24	BJK	14473
<b>Magnesium</b>	<b>34</b>	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:24	BJK	14473
<b>Manganese</b>	<b>0.023</b>	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:24	BJK	14473
<b>Potassium</b>	<b>7.6</b>	2.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:24	BJK	14473
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:24	BJK	14473
<b>Silica</b>	<b>10</b>	0.43		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:24	BJK	14473
<b>Sodium</b>	<b>110</b>	20	D2	mg/L	10	EPA200.7	8/21/07	8/22/07 12:15	BJK	14473
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/20/07	8/21/07	LB	14469



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**CLIENT:** Bio-West  
**Work Order:** 0706405  
**Lab ID:** 0706405-04  
**Project Name:** 2007 Backwater Inventory  
**Project Number:** BW Project #1119

**Client Sample ID:** A53.4  
**Collection Date:** 6/19/2007 11:30:00 AM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	110	50	D2	mg/L	20	EPA300	N/A	7/5/07	MDD	IC_070705
Fluoride	0.51	0.50		mg/L	1.0	EPA300	N/A	7/4/07	MDD	IC_070703
Sulfate	280	60	D2	mg/L	20	EPA300	N/A	7/5/07	MDD	IC_070705
Nitrogen, Ammonia (As N)	0.23	0.20		mg/L	1.0	EPA350.1	N/A	7/11/07	BAB	NH4_W-7/11/2007
Nitrogen, Kjeldahl, Total	1.4	0.50		mg/L	1.0	EPA351.2	7/3/07	7/5/07	BAB	TKN_W-7/5/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	6/29/07	TL	NO3_W-6/29/2007
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	7/7/07	7/7/07	KMB	P-TOTAL-7/9/2007
Spec. Conductance @25 C	1100	1.0		µmhos/cm	1.0	SM 2510 B	N/A	6/27/07	TL	CONDUCT-6/28/2007
Total Dissolved Solids	750	20	D2	mg/L	2.0	SM 2540 C	N/A	6/22/07	MFB	TDS_DW-6/27/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	6/25/07	MFB	TSS_W-6/27/2007
Alkalinity, Bicarbonate (As Ca)	120	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
Alkalinity, Total (As CaCO3)	120	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
Organic Carbon, Total	3.2	1.0		mg/L	1.0	SM5310C	N/A	7/9/07	CS	TOC-07/09/2007
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:46	TA	13971
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:19	BJK	13971
Barium	0.15	0.010	B1	mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:19	BJK	13971
Boron	0.18	0.10		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:19	BJK	13971
Calcium	85	1.0	B1	mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:19	BJK	13971
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:19	BJK	13971
Magnesium	36	1.0		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:19	BJK	13971
Manganese	<0.010	0.010		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:46	TA	13971
Potassium	6.6	2.0	B1	mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:19	BJK	13971
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:46	TA	13971
Silica	8.1	0.43		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:46	TA	13971
Sodium	120	20	D2	mg/L	10	EPA200.7	6/22/07	7/2/07 14:24	TA	13971
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	6/22/07	6/22/07	LB	13967



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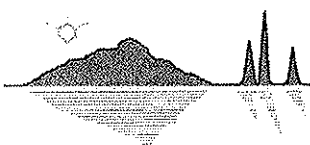
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**CLIENT:** Bio-West  
**Work Order:** 0706557  
**Lab ID:** 0706557-01  
**Project Name:**  
**Project Number:**

**Client Sample ID:** C52.5  
**Collection Date:** 6/21/2007 10:30:00 AM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	100	25	D2	mg/L	10	EPA300	N/A	7/10/07	MDD	IC_070710
Fluoride	0.51	0.50		mg/L	1.0	EPA300	N/A	7/10/07	MDD	IC_070710
Sulfate	290	30	D2	mg/L	10	EPA300	N/A	7/10/07	MDD	IC_070710
Nitrogen, Ammonia (As N)	<0.20	0.20		mg/L	1.0	EPA350.1	N/A	7/11/07	BAB	NH4_W-7/11/2007A
Nitrogen, Kjeldahl, Total	1.2	0.50		mg/L	1.0	EPA351.2	7/3/07	7/5/07	BAB	TKN_W-7/5/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	7/2/07	TL	NO3_W-7/2/2007C
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	N/A	7/14/07	BAB	P-TOTAL-7/16/2007
Spec. Conductance @25 C	1100	1.0		µmhos/cm	1.0	SM 2510 B	N/A	7/3/07	SO	CONDUCT-7/5/2007
Total Dissolved Solids	760	20	H3,D2	mg/L	2.0	SM 2540 C	N/A	6/29/07	MFB	TDS_DW-7/3/2007
Total Suspended Solids	<10	10	H3	mg/L	1	SM 2540 D	N/A	7/2/07	MFB	TSS_W-7/3/2007
Alkalinity, Bicarbonate (As C	140	20		mg/L	1.0	SM2320 B	N/A	7/5/07	KMB	ALK_W-7/5/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/5/07	KMB	ALK_W-7/5/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	7/5/07	KMB	ALK_W-7/5/2007
Alkalinity, Total (As CaCO3)	140	20		mg/L	1.0	SM2320 B	N/A	7/5/07	KMB	ALK_W-7/5/2007
Organic Carbon, Total	2.9	1.0		mg/L	1.0	SM5310C	N/A	7/10/07	CS	TOC-7/11/2007
Aluminum	0.15	0.10		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:20	BJK	14068
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:25	BJK	14068
Barium	0.15	0.010		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:20	BJK	14068
Boron	0.16	0.10		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:20	BJK	14068
Calcium	92	1.0		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:25	BJK	14068
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:25	BJK	14068
Magnesium	35	1.0		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:25	BJK	14068
Manganese	0.019	0.010		mg/L	1.0	EPA200.7	7/5/07	7/16/07 9:56	BJK	14068
Potassium	7.7	2.0		mg/L	1.0	EPA200.7	7/5/07	7/13/07 15:25	BJK	14068
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:20	BJK	14068
Silica	9.1	0.43		mg/L	1.0	EPA200.7	7/5/07	7/15/07 11:20	BJK	14068
Sodium	110	20	D2	mg/L	10	EPA200.7	7/5/07	7/13/07 16:49	BJK	14068
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	7/5/07	7/5/07	LB	14061



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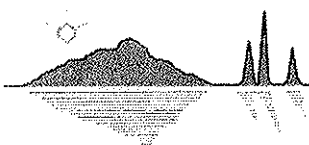
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**CLIENT:** Bio-West  
**Work Order:** 0706405  
**Lab ID:** 0706405-02  
**Project Name:** 2007 Backwater Inventory  
**Project Number:** BW Project #1119

**Client Sample ID:** A51.4  
**Collection Date:** 6/17/2007 10:30:00 AM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	120	50	D2	mg/L	20	EPA300	N/A	7/5/07	MDD	IC_070705
Fluoride	0.57	0.50		mg/L	1.0	EPA300	N/A	7/4/07	MDD	IC_070703
Sulfate	300	60	D2	mg/L	20	EPA300	N/A	7/5/07	MDD	IC_070705
Nitrogen, Ammonia (As N)	0.27	0.20		mg/L	1.0	EPA350.1	N/A	7/11/07	BAB	NH4_W-7/11/2007
Nitrogen, Kjeldahl, Total	2.2	0.50		mg/L	1.0	EPA351.2	7/3/07	7/5/07	BAB	TKN_W-7/5/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	7/9/07	TL	NO3_W-7/09/2007
Phosphorus, Total (As P)	<0.050	0.050		mg/L	1.0	EPA365.3	7/7/07	7/7/07	KMB	P-TOTAL-7/9/2007
Spec. Conductance @25 C	1100	1.0		umhos/cm	1.0	SM 2510 B	N/A	6/27/07	TL	CONDUCT-6/28/2007
Total Dissolved Solids	780	20	D2	mg/L	2.0	SM 2540 C	N/A	6/22/07	MFB	TDS_DW-6/27/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	6/22/07	MFB	TSS_W-6/25/2007
Alkalinity, Bicarbonate (As Ca	92	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
Alkalinity, Total (As CaCO3)	94	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
Organic Carbon, Total	3.5	1.0		mg/L	1.0	SM5310C	N/A	7/9/07	CS	TOC-07/09/2007
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:32	TA	13971
Arsenic	<0.010	0.010		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:12	BJK	13971
Barium	0.13	0.010	B1	mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:12	BJK	13971
Boron	0.20	0.10		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:12	BJK	13971
Calcium	76	1.0	B1	mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:12	BJK	13971
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:12	BJK	13971
Magnesium	37	1.0		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:12	BJK	13971
Manganese	<0.010	0.010		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:32	TA	13971
Potassium	5.4	2.0	B1	mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:12	BJK	13971
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:32	TA	13971
Silica	7.9	0.43		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:32	TA	13971
Sodium	140	20	D2	mg/L	10	EPA200.7	6/22/07	7/2/07 14:17	TA	13971
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	6/22/07	6/22/07	LB	13967





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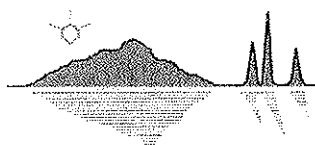
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**CLIENT:** Bio-West  
**Work Order:** 0706405  
**Lab ID:** 0706405-01  
**Project Name:** 2007 Backwater Inventory  
**Project Number:** BW Project #1119

**Client Sample ID:** A49.2  
**Collection Date:** 6/18/2007 12:30:00 PM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
<b>Chloride</b>	<b>370</b>	50	D2	mg/L	20	EPA300	N/A	7/5/07	MDD	IC_070705
<b>Fluoride</b>	<b>6.8</b>	0.50		mg/L	1.0	EPA300	N/A	7/3/07	MDD	IC_070703
<b>Sulfate</b>	<b>300</b>	60	D2	mg/L	20	EPA300	N/A	7/5/07	MDD	IC_070705
Nitrogen, Ammonia (As N)	<0.20	0.20		mg/L	1.0	EPA350.1	N/A	7/11/07	BAB	NH4_W-7/11/2007
<b>Nitrogen, Kjeldahl, Total</b>	<b>1.4</b>	0.50		mg/L	1.0	EPA351.2	7/3/07	7/5/07	BAB	TKN_W-7/5/2007
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	6/29/07	TL	NO3_W-6/29/2007
<b>Phosphorus, Total (As P)</b>	<b>0.062</b>	0.050		mg/L	1.0	EPA365.3	7/7/07	7/7/07	KMB	P-TOTAL-7/9/2007
<b>Spec. Conductance @25 C</b>	<b>2100</b>	1.0		µmhos/cm	1.0	SM 2510 B	N/A	6/27/07	TL	CONDUCT-6/28/2007
<b>Total Dissolved Solids</b>	<b>1300</b>	40	D2	mg/L	4.0	SM 2540 C	N/A	6/22/07	MFB	TDS_DW-6/27/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	6/22/07	MFB	TSS_W-6/25/2007
<b>Alkalinity, Bicarbonate (As Ca)</b>	<b>160</b>	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
<b>Alkalinity, Total (As CaCO3)</b>	<b>160</b>	20		mg/L	1.0	SM2320 B	N/A	6/28/07	KMB	ALK_W-6/29/2007
<b>Organic Carbon, Total</b>	<b>3.9</b>	1.0		mg/L	1.0	SM5310C	N/A	7/9/07	CS	TOC-07/09/2007
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:28	TA	13971
<b>Arsenic</b>	<b>0.034</b>	0.010		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:09	BJK	13971
<b>Barium</b>	<b>0.038</b>	0.010	B1	mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:09	BJK	13971
<b>Boron</b>	<b>0.92</b>	0.10		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:09	BJK	13971
<b>Calcium</b>	<b>40</b>	1.0	B1	mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:09	BJK	13971
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:09	BJK	13971
<b>Magnesium</b>	<b>5.9</b>	1.0		mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:09	BJK	13971
<b>Manganese</b>	<b>0.028</b>	0.010		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:28	TA	13971
<b>Potassium</b>	<b>12</b>	2.0	B1	mg/L	1.0	EPA200.7	6/22/07	6/28/07 1:09	BJK	13971
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:28	TA	13971
<b>Silica</b>	<b>50</b>	0.43		mg/L	1.0	EPA200.7	6/22/07	6/29/07 18:28	TA	13971
<b>Sodium</b>	<b>500</b>	20	D2	mg/L	10	EPA200.7	6/22/07	7/2/07 14:13	TA	13971
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	6/22/07	6/22/07	LB	13967



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**CLIENT:** Bio-West  
**Work Order:** 0708597  
**Lab ID:** 0708597-06  
**Project Name:**  
**Project Number:**

**Client Sample ID:** C48.5  
**Collection Date:** 8/13/2007 11:00:00 AM  
**Matrix:** Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	210	25	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Fluoride	1.4	0.50		mg/L	1.0	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Sulfate	470	30	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Nitrogen, Ammonia (As N)	<0.20	0.20		mg/L	1.0	EPA350.1	N/A	8/22/07	ZDP	NH4_W-8/22/2007B
Nitrogen, Kjeldahl, Total	0.77	0.50		mg/L	1.0	EPA351.2	N/A	8/24/07	ZDP	TKN_W-8/24/2007A
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/22/07	TL	NO3_W-8/22/2007B
Phosphorus, Total (As P)	0.37	0.050		mg/L	1.0	EPA365.3	8/25/07	8/25/07	HB	P-TOTAL-8/25/2007
Spec. Conductance @25 C	1800	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/24/07	SO	CONDUCT-8/24/2007
Total Dissolved Solids	1200	40	D2	mg/L	4.0	SM 2540 C	N/A	8/17/07	MAG	TDS_DW-8/21/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/17/07	MFB	TSS_W-8/19/2007
Alkalinity, Bicarbonate (As Ca	140	20		mg/L	1.0	SM2320 B	N/A	8/27/07	TA	ALK_W-8/27/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/27/07	TA	ALK_W-8/27/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/27/07	TA	ALK_W-8/27/2007
Alkalinity, Total (As CaCO3)	140	20		mg/L	1.0	SM2320 B	N/A	8/27/07	TA	ALK_W-8/27/2007
Organic Carbon, Total	9.8	5.0	D1	mg/L	5.0	SM5310C	N/A	8/28/07	MDD	TOC_W-8/28/2007A
Aluminum	0.13	0.10		mg/L	1.0	EPA200.7	8/21/07	8/22/07 12:55	BJK	14473
Arsenic	0.011	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:39	BJK	14473
Barium	0.069	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:39	BJK	14473
Boron	0.42	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:39	BJK	14473
Calcium	84	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:39	BJK	14473
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:39	BJK	14473
Magnesium	30	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:39	BJK	14473
Manganese	0.13	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:39	BJK	14473
Potassium	17	2.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:39	BJK	14473
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:39	BJK	14473
Silica	49	0.43		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:39	BJK	14473
Sodium	300	20	D2	mg/L	10	EPA200.7	8/21/07	8/22/07 12:36	BJK	14473
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/20/07	8/21/07	LB	14469



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CLIENT: Bio-West  
Work Order: 0708597  
Lab ID: 0708597-04  
Project Name:  
Project Number:

Client Sample ID: C48.2  
Collection Date: 8/13/2007 1:00:00 PM  
Matrix: Water

Analyte	Result	PQL	Qual	Units	DF	Test Code	Date Prepared	Date Analyzed	Analyst	Batch ID
Chloride	180	25	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Fluoride	1.1	0.50		mg/L	1.0	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Sulfate	440	30	D2	mg/L	10	EPA300	N/A	8/24/07	TL	IC-8/24/2007
Nitrogen, Ammonia (As N)	<0.20	0.20		mg/L	1.0	EPA350.1	N/A	8/22/07	ZDP	NH4_W-8/22/2007B
Nitrogen, Kjeldahl, Total	0.78	0.50		mg/L	1.0	EPA351.2	N/A	8/24/07	ZDP	TKN_W-8/24/2007A
Nitrate-Nitrite (As N)	<0.50	0.50		mg/L	1.0	EPA353.2	N/A	8/22/07	TL	NO3_W-8/22/2007D
Phosphorus, Total (As P)	9.5	5.0	D2	mg/L	100	EPA365.3	8/25/07	8/25/07	HB	P-TOTAL-8/25/2007
Spec. Conductance @25 C	1600	1.0		µmhos/cm	1.0	SM 2510 B	N/A	8/24/07	SO	CONDUCT-8/24/2007
Total Dissolved Solids	1100	20	D2	mg/L	2.0	SM 2540 C	N/A	8/17/07	MAG	TDS_DW-8/21/2007
Total Suspended Solids	<10	10		mg/L	1	SM 2540 D	N/A	8/17/07	MFB	TSS_W-8/19/2007
Alkalinity, Bicarbonate (As Ca)	120	20		mg/L	1.0	SM2320 B	N/A	8/27/07	TA	ALK_W-8/27/2007
Alkalinity, Carbonate (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/27/07	TA	ALK_W-8/27/2007
Alkalinity, Hydroxide (As CaCO3)	<20	20		mg/L	1.0	SM2320 B	N/A	8/27/07	TA	ALK_W-8/27/2007
Alkalinity, Total (As CaCO3)	120	20		mg/L	1.0	SM2320 B	N/A	8/27/07	TA	ALK_W-8/27/2007
Organic Carbon, Total	5.7	5.0	D1	mg/L	5.0	SM5310C	N/A	8/28/07	MDD	TOC_W_8/28/2007A
Aluminum	<0.10	0.10		mg/L	1.0	EPA200.7	8/21/07	8/22/07 12:47	BJK	14473
Arsenic	0.011	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:31	BJK	14473
Barium	0.069	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:31	BJK	14473
Boron	0.34	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:31	BJK	14473
Calcium	81	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:31	BJK	14473
Iron	<0.10	0.10		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:31	BJK	14473
Magnesium	31	1.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:31	BJK	14473
Manganese	0.076	0.010		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:31	BJK	14473
Potassium	16	2.0		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:31	BJK	14473
Selenium	<0.025	0.025		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:31	BJK	14473
Silica	58	0.43		mg/L	1.0	EPA200.7	8/21/07	8/21/07 17:31	BJK	14473
Sodium	260	20	D2	mg/L	10	EPA200.7	8/21/07	8/22/07 12:29	BJK	14473
Mercury	<0.0002	0.0002		mg/L	1.0	EPA245.1	8/20/07	8/21/07	LB	14469

TKN and Ammonia were analyzed separately from the other analytes for the following sites:

A67.5

A67.9

A67.6b

A69.7c

C65.0

These results are displayed separately on the following 2 pages



ANALYTICAL TESTING CORPORATION

Transwest Geochem  
3725 E. Atlanta Ave. Suite 2  
Phoenix, AZ 85040  
Attention: Carlene McCutcheon

Project ID: 0707290 2007 Backwater Site Visits

Report Number: PQG0798

Sampled: 07/07/07-07/11/07  
Received: 07/25/07

**INORGANICS**

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PQG0798-01 (A67.5 (0707290-01E) - Water)				Sampled: 07/07/07				
Reporting Units: mg/l								
Ammonia-N	EPA 350.3	P7G2508	0.050	0.16	1	7/25/2007	7/25/2007	
Sample ID: PQG0798-02 (A-67.9 (0707290-02E) - Water)				Sampled: 07/09/07				
Reporting Units: mg/l								
Ammonia-N	EPA 350.3	P7G2508	0.050	0.071	1	7/25/2007	7/25/2007	
Sample ID: PQG0798-03 (A67.9B (0707290-03E) - Water)				Sampled: 07/10/07				
Reporting Units: mg/l								
Ammonia-N	EPA 350.3	P7G2508	0.050	0.10	1	7/25/2007	7/25/2007	
Sample ID: PQG0798-04 (A69.7C (0707290-04E) - Water)				Sampled: 07/08/07				
Reporting Units: mg/l								
Ammonia-N	EPA 350.3	P7G2508	0.050	0.063	1	7/25/2007	7/25/2007	
Sample ID: PQG0798-05 (C65.0 (0707290-05E) - Water)				Sampled: 07/11/07				
Reporting Units: mg/l								
Ammonia-N	EPA 350.3	P7G2508	0.050	0.071	1	7/25/2007	7/25/2007	

**TestAmerica - Phoenix, AZ**

Linda Eshelman For Karen Maxwell  
Regional Account Manager

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**PQG0798 <Page 2 of 7>**

Transwest Geochem  
3725 E. Atlanta Ave. Suite 2  
Phoenix, AZ 85040  
Attention: Carlene McCutcheon

Project ID: 0707290 2007 Backwater Site Visits

Report Number: PQG0798

Sampled: 07/07/07-07/11/07  
Received: 07/25/07

## General Chemistry Parameters

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PQG0798-01 (A67.5 (0707290-01E) - Water)				Sampled: 07/07/07				
Reporting Units: mg/L								
Total Kjeldahl Nitrogen	EPA 351.2	7080006	0.100	0.381	1	8/1/2007	8/2/2007	
Sample ID: PQG0798-02 (A-67.9 (0707290-02E) - Water)				Sampled: 07/09/07				
Reporting Units: mg/L								
Total Kjeldahl Nitrogen	EPA 351.2	7080006	0.100	0.279	1	8/1/2007	8/2/2007	
Sample ID: PQG0798-03 (A67.9B (0707290-03E) - Water)				Sampled: 07/10/07				
Reporting Units: mg/L								
Total Kjeldahl Nitrogen	EPA 351.2	7080006	0.100	0.328	1	8/1/2007	8/2/2007	
Sample ID: PQG0798-04 (A69.7C (0707290-04E) - Water)				Sampled: 07/08/07				
Reporting Units: mg/L								
Total Kjeldahl Nitrogen	EPA 351.2	7080006	0.100	0.318	1	8/1/2007	8/2/2007	
Sample ID: PQG0798-05 (C65.0 (0707290-05E) - Water)				Sampled: 07/11/07				
Reporting Units: mg/L								
Total Kjeldahl Nitrogen	EPA 351.2	7080006	0.100	0.341	1	8/1/2007	8/2/2007	

TestAmerica - Phoenix, AZ

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Regional Account Manager

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